SELECTED

# **ESOURCES**ABSTRACTS

VOLUME 4, NUMBER 17 SEPTEMBER 1, 1971 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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# WATER RESOURCES ABSTRACTS

'A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



**VOLUME 4, NUMBER 17** SEPTEMBER 1, 1971

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

#### FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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#### 01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

#### 02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

#### 03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

#### 04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

#### 05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

## **06 WATER RESOURCES PLANNING**

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

#### **07 RESOURCES DATA**

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

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#### 09 MANPOWER, GRANTS, AND FACILITIES

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# SELECTED WATER RESOURCES ABSTRACTS

#### 02. WATER CYCLE

#### 2A. General

RAINFALL-RUNOFF-HYDROGRAPH RELA-TIONS FOR NORTHERN LOUISIANA, Geological Survey, Baton Rouge, La. V. B. Sauer.

Louisiana Department of Public Works Technical Report No 3, 1970. 33 p, 8 fig, 4 tab, 29 ref.

Descriptors: \*Rainfall-runoff relationships, \*Louisiana, \*Streamflow forecasting, \*Base flow, \*Surface runoff, \*Structural design, River flow, Regulated flow, Natural flow, Discharge measurement, Gaging stations, Water measurement, Rainfall Gaging stations, Water measurement, Rainfall disposition, Rain gages, Rainfall intensity, Runoff forecasting, Hydrologic data, Data collections, Meteorological data, Climatic data, Unit hydrographs, Hydrograph analysis, River forecasting, Storm runoff, Precipitation excess.

Identifiers: \*Ouachita River (La), \*Red River (La), \*Louisiana Coastal Plain.

Streamflow records from 22 gaging stations and more than 90 rain gages were used to study the relation between rainfall, rainfall excess, and runoff hydrographs in northern Louisiana. Unit hydrographs were developed from the streamflow records and regionalized for use at any site in the study area. The regionalized dimensionless unit hydrograph can be converted to a specific unit hydrograph for a site from known values of drainage basin size and length and an estimated value of lag time. Basin lag time, a critical factor, is related to basin characteristics and, inversely, to total volume of rainfall excess for a given storm. The accuracy of the lag time and unit-hydrograph relations is fairly good if the true amount of rainfall excess is known. A random test indicated a standard error of estimate of 22 percent. (Glasby-USGS) W71-09087

CALCULATING RAINFALL RUNOFF LOSSES BY PRECIPITATION AND RUNOFF LOSSES BY PRECIPITATION AND RUNOFF OF SMALL RIVERS USING THE DNIEPER RIVER-RECHITSA BASIN AS AN EXAMPLE (RUS-SIAN: VYCHISLENIYE POTER' DOZH-DEVOGO STOKA PO OSADKAM I STOKU MA-LYKH REK NA PRIMERE BASSEYNA R. DNEPRA DO G. RECHITSY),

For primary bibliographic entry see Field 02E. W71-09128

STUDY OF THE RELATIONSHIP BETWEEN ANNUAL RUNOFF OF RIVERS OF THE USSR AND ATMOSPHERIC CIRCULATION (RUSSIAN: ISSLEDOVANIYE ZAVISIMOSTI GODOVOGO STOKA REK SSSR OT AT-MOSFERNOY TSIRKULYATSII),

N. A. Aniskina.

In: Problems in Hydrological Forecasting (Voprosy Ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 63-98, 1970. 36 p, 8 fig, 3 tab, 20 ref.

Descriptors: \*Hydrologic cycle, \*Rivers, \*Runoff, \*Air circulation, \*Moisture content, River basins, Precipitation (Atmospheric), River forecasting, Meteorological data, Distribution patterns, Synoptic analysis, Cyclones, Anticyclones.
Identifiers: \*USSR, European USSR, Western Siberia, Synoptic processes.

Long-term fluctuations in the water content of lowland rivers of the USSR are dependent upon fluctuations in atmospheric circulation expressed by an alternating occurrence of one or two of the by an alternating occurrence of one of two of the three types of atmospheric circulation--western, meridional, and eastern. Annual runoff data are given for 31 rivers of the European USSR with basin areas ranging in size from 3,780 to 48,300 sq km and for 39 rivers in the Asiatic part of the Soviet Union, several of which have basin areas over 100,000 sq km. To determine the character of the relationship of water content to different types of atmospheric circulation, a study was made of the distribution of cyclone and anticyclone activity and of precipitation anomalies peculiar to each circulation type. Fluctuations in the water content of rivers of several geographical regions for the period 1921-1962 are related to fluctuations in the recurrence of any two types of circulation. In some regions correlation indices of the relationship are 0.65-0.70. In predicting atmospheric circulation the relationships of water content to the three circulation types can be used as a basis for preparing long-term forecasts for USSR rivers. (Josefson-USGS) W71-09136

STUDY OF PRECIPITATION, STREAM-FLOW, AND WATER USAGE ON THE UPPER RIO GRANDE,

Environmental Science Services Admin., El Paso, Tex.; and Bureau of Reclamation, El Paso, Tex. Elden V. Jetton, and James W. Kirby.

Texas University Atmospheric Science Group Report No 25, June 1970, 203 p, 45 fig, 31 tab, 43 ref,

Descriptors: \*Rainfall-runoff relationships, \*Water balance, \*Rio Grande, \*Colorado, \*New Mexico, Evapotranspiration, Irrigation water, Phreatophytes, Streamflow, Hydrologic budget, Climatology, Droughts, Water supply, Water yield, Water utilization, Consumptive use, Water allocation (Policy). Identifiers: Upper Rio Grande Basin.

The upper Rio Grande watershed is one of the oldest inhabited, oldest irrigated, and fastest growing sections of the United States. The water resources of the basin may be overcommitted under the present form of usage. Drought during the late 1940's and the 1950's caused disastrous reductions in streamflow. Water delivered to New Mexico and Texas declined much more than did the annual rainfall over the Rio Grande Basin in Colorado or the streamflow upstream of areas of significant diversions and use. Part of the cline in surface water production may be attributable to small conservation tanks and other water-retarding developments. The loss of water in the Middle Section to nonbeneficial evapotranspiration is estimated at over one-half million acre-feet. Deliveries under the Rio Grande Compact have not closely reflected climatological or hydrological conditions. The economic effects caused by the reduction of water in the lower reaches of the basin have been very severe. The principal cause seems to be stream depletions in Colorado. (Knapp-USGS) W71-09310

RIVER RUNOFF - THEORY AND ANALYSIS, For primary bibliographic entry see Field 02E. W71-90278

#### 2B. Precipitation

HYDROLOGIC STUDY OF THE YAGUEZ RIVER WATERSHED,

Puerto Rico Univ., Mayaguez. Water Resources Research Inst. For primary bibliographic entry see Field 07C.

W71-08971

CHARACTERISTICS OF CHEMICAL PRECIPITATION IN THE CHAMPLAIN VAL-

Vermont Univ., Burlington. Dept. of Zoology. For primary bibliographic entry see Field 02K.

PRECIPITATION, ITS CHEMICAL COMPOSI-TION AND EFFECT ON SOIL WATER IN A

BEECH AND A SPRUCE FOREST IN SOUTH SWEDEN,

Lund Univ. (Sweden). Dept. of Plant Ecology. For primary bibliographic entry see Field 02K. W71-09081

CARBON MONOXIDE IN RAINWATER.

Naval Research Lab., Washington, D.C. J. W. Swinnerton, R. A. Lamontagne, and V. J. Linnenbom.

Science, Vol 172, No 3986, p 943-945, May 28, 1971. 3 p, 1 tab, 11 ref.

Descriptors: \*Gases, \*Air environment, \*Precipitation (Atmospheric), \*Rain water, Atlantic Ocean, Pacific Ocean, Hawaii, Carbon dioxide, Methane, Organic matter, Vapor pressure, Pollutants. Identifiers: \*Geochemical cycle, \*Carbon monox-

To help specify the various sources and sinks which play essential roles in the geochemical cycle involving carbon monoxide in the atmosphere, rainwater and air samples were collected for analysis at three locations--in Washington, D.C., over the Pacific Ocean, and on the island of Hawaii. Concentrations of carbon monoxide in rainwater collected at these widely diverse locations show up to 200-fold supersaturation relative to the partial pressure of the atmospheric gas. These results indicate existence of an additional natural source of carbon monoxide. probably the oceans, not heretofore considered. Production of this gas in clouds is tentatively attributed to photochemical oxidation of organic matter or the slight dissociation of carbon dioxide induced by electrical discharges, or both. Methane concentrations measured in the same rainwater show that partitioning of this gas, unlike that of carbon monoxide, is very close to a state of equilibrium. (Lang-USGS) W71-09105

NUMBER AND SPACING OF RAINFALL-GAUGES IN A DECIDUOUS FOREST STAND,

Wroclaw Univ. (Poland). Inst. of Botany; and Polish Academy of Sciences, Bialystok. Mammals Research Inst.

Maciej S. Czarnowski, and Jerzy L. Olszewski. Oikos, Vol 21, No 1, p 48-51, 1970. 4 p, 2 fig, 2 tab, 8 ref.

Descriptors: \*Rain gages, \*Forests, \*Network design, \*Data collections, \*Instrumentation, Hydrologic data, Meteorological data, Regional analysis, Stations, Gaging stations, Rainfall. Identifiers: \*Poland.

The representative number of rainfall-gages for measuring rainfall under a forest canopy and the best spacing of these gages were determined. The experiment was made in 1963 in a deciduous stand in Bialowieza Primeval Forest (Poland). It is desirable to use at least 30 rainfall-gages, and measurement of rainfall does not, practically speaking, depend on the spacing of these gages when they are arranged in a regular network. (Knapp-USGS) W71-09138

NIMBUS WEATHER SATELLITES: REMOTE SOUNDING OF THE ATMOSPHERE, For primary bibliographic entry see Field 07B.

SOIL: A NATURAL SINK FOR CARBON MONOXIDE,

Stanford Research Inst., Irvine, Calif. For primary bibliographic entry see Field 02G. W71-09297

W71-09271

## Group 2C-Snow, Ice, and Frost

2C. Snow, Ice, and Frost

OF ICE PREVENTION FIELD TESTS TECHNIQUES,

Corps of Engineers, Anchorage, Alaska. Alaska

For primary bibliographic entry see Field 04A. W71-08976

LONG-RANGE FORECASTING OF ICE BREAKUP ON RIVERS OF THE SEVERNYY KRAY (RUSSIAN: VSKRITIYE REK SEVERNOGO KRAYA I METODIKA YEGO DOLGOSROCHNOGO PROGNOZA), T. N. Makarevich, N. A. Aniskina, Z. A. Yefimova, O. N. Potapova, and L. K. Savina. In: Problems in Hydrological Forecastic.

In: Problems in Hydrological Forecasting (Voprosy gidrologicheskikh prognozov), Gosudarstvennyy Ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 3-62, 1970. 60 p, 13 fig, 12 tab, 23 ref, 2 append.

Descriptors: \*Ice breakup, \*Forecasting, \*Rivers, \*Climatic data, Synoptic analysis, Air temperature, Water temperature, Air circulation, Meteorology, Seasonal, Heat balance.

Identifiers: \*USSR, Severnyy Kray, Debacle, Ice

A long-range forecast of ice breakup on rivers of the Severnyy Kray is based on analyzing the peculiarities of the spring regime of rivers and the character of the atmospheric processes which determine them. Breakup periods for rivers flowing in a northern direction are determined by the time of start and the discharge of spring high water at the upper reaches of the rivers. Ice breakup on rivers of the Severnyy Kray occurs in the period between April 20-30 and May 20-30, and generally lasts 35-40 days. Air pressure anomalies, October-March, March air temperatures in the Atlantic-European synoptic region, the Barents Sea temperature in March, and air temperatures at local stations during the last ten days of March are descriptive of the predominant macroprocesses responsi-ble for ice breakup on rivers. The quantitative relationships derived satisfy requirements set forth by current forecasting instructions. (Josefson-USGS) W71-09126

# CALCULATING MAXIMUM ICE JAM LEVELS OF THE NEVA RIVER (RUSSIAN: RASCHET MAKSIMAL'NYKH ZAZHORNYKH UROVNEY

R. A. Nezhikhovskiy, and G. V. Ardasheva. In: Problems in Hydrological Forecasting (Voprosy ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 164-169, 1970. 6 p, 2 fig, 1 tab, 4 ref.

Descriptors: \*Ice jams, \*Rivers, \*Water level fluctuations, \*Flow profiles, Discharge (Water), Air temperature, Probability, Statistical methods, Forecasting.
Identifiers: \*USSR, Lake Ladoga, Neva River.

The formation of ice jams on the Neva River depends upon water content of the river during freezing, amount of incoming ice from Lake Ladoga, and air temperature rate. Longitudinal profiles of the water surface are used to analyze fluctuations in the water level during ice jams. To calculate maximum ice jam levels of varying recurrence, empirical probability curves are constructed for a number of points at which long-term observations have been conducted (60-80 years). Probability curves of maximum ice jam levels are extrapolated into the region of rare recurrence. Graphs are constructed showing the change in equivalent values of maximum ice jam levels by river length (P-0.1; 1; 5; 20; 50%). The method used to compute maximum ice jam levels for the length of the Neva River can also be used for other rivers when ample observation points are available. (Josefson-USGS) W71-09130

PERENNIAL ICE AND SNOW MASSES--A GUIDE FOR COMPILATION AND ASSEM-BLAGE OF DATA FOR A WORLD INVENTO-

UNESCO--IASH Contribution to International Hydrological Decade: UNESCO Technical Papers in Hydrology, No 1, 1970. 59 p, 26 fig, 9 tab, 5 ref.

Descriptors: \*Snow surveys, \*Glaciers, \*Ice, \*Data collections, \*International Hydrological Decade, \*Permafrost, Water yield, Regimen, Water resources development, Water resources, Runoff, Melt water, Standards, Stations, Snowpacks, Antarctic, Water balance, Heat balance, Snowmelt. Identifiers: \*Glacier surveys, \*Snow and ice inven-

Since about 80 percent of all fresh water exists in solid form, an accurate assessment of the amount, distribution and variation of all snow masses, both near and far from areas at present inhabited is of importance for the understanding of man's environment. To comply with the need for more complete and detailed informtion on ice and snow, the Co-ordinating Council of the IHD at its first session passed a resolution recommending to Member States the mapping and inventory of permanent snow and ice masses and the compilation and assemblage of data for publication in order to obtain the elements necessary for the establishment of the regional distribution of permanent and seasonal snow, permafrost and ice. Guidance and inventory methods are given for the compilation of a world inventory of perennial and seasonal ice and snow masses as a contribution to the estimation of the world water balance. (Knapp-USGS) W71-09311

#### 2D. Evaporation and Transpiration

#### ESTIMATING EVAPOTRANSPIRATION: AN **EVALUATION OF TECHNIQUES,**

Australian Water Resources Council, Camberra. Dept. of National Development.

C. S. Christian, R. O. Slatyer, C. E. Hounam, K. C. Leverington, and W. C. Swinbank.

Australian Water Resources Council Hydrological Series 5, 1970. 23 p, 49 ref.

Descriptors: \*Evapotranspiration, \*Energy budget, \*Water balance, \*Transpiration, \*Hydrologic cycle, Water conservation, Saturated soils, Lysimeters, Irrigation effects, Microenvironment, Soil water movement, Evaporation, Moisture content, Water loss, Percolation, Underseepage, Infiltra-tion, Wilting point, Forests, Soil properties. Identifiers: Soil water storage.

This report reviews some of the experimental and theoretical procedures used in the evaluation and study of soil and plant evapotranspiration. It discusses the use of lysimeters of the soil-weighing type used in measuring evaporation rates. In this connection it is quite possible that weighing lysimeters can provide a more accurate measurement than the energy balance approach. However, their constant use under all conditions is somewhat restricted as the plant and soil community reproduced within the lysimeter pot must match very closely the plant and soil community being studies so as to obtain an accurate evaporation reading. This report further states that it is believed at present that the only suitable method for the measurement of evaporation from most land surfaces is that based on the evaluation of surface energy balance. Also included are specific mathematical formulas relating to catchment studies, energy balance approach, instrumentation, and estimation procedures. (Glasby-USGS) W71-09312

#### 2E. Streamflow and L.

HYDROLOGIC STUDY OF THE YAGUEZ RIVER WATERSHED,
Puerto Rico Univ., Mayaguez. Water Resources

Research Inst.

For primary bibliographic entry see Field 07C. W71-08971

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS - 1969,

Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W71-09080

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA AND MUKEWATER CREEK, COLORADO RIVER BASIN, TEXAS,

Geological Survey, Austin, Tex. Water Resources

For primary bibliographic entry see Field 07C. W71-09083

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR CALAVERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1969,

Geological Survey, Austin, Tex. Water Resources

For primary bibliographic entry see Field 07C. W71-09084

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1969,

Geological Survey, Austin, Tex., Water Resources

For primary bibliographic entry see Field 07C. W71-09086

RAINFALL-RUNOFF-HYDROGRAPH RELA-TIONS FOR NORTHERN LOUISIANA, Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 02A. W71-09087

A PROPOSED STREAMFLOW DATA PROGRAM FOR TEXAS.

Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07A. W71-09094

LOW-FLOW STUDY FOR SOUTHWEST OHIO

STREAMS, Geological Survey, Columbus, Ohio. Earl E. Webber, and Ronald I. Mayo Geological Survey Open-file Report, May 1971. 14 p, 1 fig, 1 tab, 5 ref.

Descriptors: \*Streamflow, \*Low flow, \*Discharge measurement, \*Data collections, \*Ohio, Hydrologic data, Flow rates, Stream gages, Gaging stations, Surface-groundwater relationships, Runoff, Base

Identifiers: Little Miami River, Mill Creek, Great Miami River, Wabash River.

Low-flow discharges at 60 sites on streams in the Little Miami River, Mill Creek, Great Miami River and Wabash River basins in Ohio are presented. The average annual minimum flow in cubic feet per a 1-day period of 10-year frequency and a 1-day period of 30-year frequency are computed for each of the 60 sites. All of the gaging records for naturally-flowing streams and miscellaneous low-flow discharge measurements in southwest Ohio during the period 1914-70 were used. (Woodard-USGS)

AN ANCIENT HYDROGRAPHIC NETWORK AN ANCIENT HYDROGRAPHIC NETWORK ON THE KAMA, PECHORA AND VYCHEGDA INTERFLUVE (RUSSIAN: DREVNYAYA GIDROGRAFICHESKAYA SET' NA MEZHDURECH'YE KAMY, PECHORY I VYCHEGDY), All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR).

N. V. Ryabkov.

Akademiya nauk SSSR Izvestiya, Seriya Geograficheskaya, no 1, p 100-108, Jan-Feb, 1971. 9 p, 4 fig, 4 ref.

Descriptors: \*Geologic investigations, \*History, \*Interfluves, \*Rivers, Hydrography, Stratigraphy, Quaternary period, Canyons, Valleys, Pleistocene epoch, Geomorphology, Palynology, Terraces (Geological), Cross-sections. Identifiers: \*USSR, \*Caspian Sea, Kama River, Pechora River, Vychegda River, Paleogeography, Quaternary deposits.

Drilling operations along the tributaries of the Kama and Vychegda Rivers show a deep valley referred to in literature as the 'Kel'tminskiy Canyon.' A similar deepening was discovered in 1967 north of the canyon along the Vychegda and Pechora tributaries. Subsequent investigations to the east have uncovered ancient valleys along the Kama and Pechora tributaries. Subsequent investigations to the east have uncovered ancient valleys along the Kama and Pechora tributaries. The Kama, Pechora and Vychegda basin may be used to compare and correlate the stratigraphy of Quaternary deposits in the Caspian and Severnyy (boreal) basins. Reconstruction of the historical development of the basin's stream network is valuable for correlating the Pleistocene deposits filling the val-leys for drafting local measures to divert runoff of northern rivers into the Caspian Sea. (Josefson-USGS) W71-09102

HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI

Geological Survey, Baton Rouge, La.

Duane E. Everett.

Louisiana Department of Public Works Technical Report No 5, 1971. 48 p, 34 fig, 3 plate, 4 tab, 8

Descriptors: \*Mississippi River, \*Louisiana, \*Water quality, \*Industrial wastes, \*Water pollution, Water utilization, Sewage, Sediment load, Supension, Colloids, Sediment transport, Industrial water, Chemical wastes, Pollutants, Waste disposal, Waste water disposal, Municipal wastes, Sewage treatment, Sewage effluents, Public health, River flow, Open channel flow, Flow rates. Identifiers: New Orleans (La), Baton Rouge (La).

Maintaining the suitability of its water for mu-Maintaining the suitability of its water for indicipal and industrial uses must be included in the proper utilization of the lower Mississippi River. The average daily flow of the Mississippi River at Vicksburg is 551,100 cfs, ranging from a high of 2,280,000 cfs on May 4, 1927, to a low of 100,000 cfs on October 17, 1939. Sediment concentrations cfs on October 17, 1939. Sediment concentrations at Red River Landing range from about 10 to 2,500 mg/l. The average annual suspended-sediment load is 750,000 tons per day, ranging from 288,000 tons per day in 1963 to 1,580,000 tons per day in 1951. Industrial demands for water from the Mississippi River have increased from 2.0 bgd in 1960 to 5.0 bgd in 1969; 95% of this water is returned to the river. Domestic sewage discharged into the Missis-sippi River causes high bacterial concentrations. In 1962 the coliform content exceeded 5,000 colonies per 100 milliliters about 13% of the time at the New Orleans Carrollton Street intake (mile 104) and about 35% of the time at the Algiers intake (mile 95). When the river is flowing at a rate of 600,000 cfs an accidental spill of 1,000 pounds of contaminant at Baton Rouge would have a peak concentration in New Orleans of 0.83 micrograms per liter 60 hours later. Under average flow condi-tions the rate of lateral dispersion of bank-injected contaminants would be about 250 feet per mile in straight reaches of the river. (Glasby-USGS) W71-09103

BEHAVIOR OF POROUS BED NEAR FLOW

SINGULARITY,
Karlsruhe Univ. (West Germany). Institut fuer
Hydromechanik, Straunanlagen and Wasserversorgung; and Georgia Inst. of Technology, Atlanta.
School of Civil Engineering.
For primary bibliographic entry see Field 02G.
W71-09108

RECORDS OF PRECIPITATION, WATER LEVELS AND GROUNDWATER RECHARGE TO THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS,

Geological Survey, San Antonio, Tex. For primary bibliographic entry see Field 02F. W71-09111

FLOOD PLAIN INFORMATION ON DAYS CREEK AND TRIBUTARIES AT TEXARKANA,

ARKANSAS-TEXAS.
Corps of Engineers, New Orleans, La For primary bibliographic entry see Field 04A.
W71-09114

FLOOD PLAIN INFORMATION-CAPE FEAR RIVER AND CROSS CREEK WATERSHED, FAYETTEVILLE, NORTH CAROLINA. Corps of Engineers, Wilmington, N.C.

For primary bibliographic entry see Field 04A. W71-09115

REFINING THE CALCULATION AND FORECAST OF RAINFALL RUNOFF OF LARGE AND MEDIUM-SIZE RIVERS BY RUNOFF FROM SMALL BASINS, (RUSSIAN: UTOCHNENIYE METODA VYCHISLENIYA I PROGNOZA DOZHDEVOGO STOKA OCCUPILI LEPENNIKH PEK PO STOKI BOL'SHIKH I SREDNIKH REK PO STOKU S MALYKH BASSEYNOV),

N. N. Osadchaya.
In: Problems in Hydrological Forecasting (Voprosy ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 136-163, 1970. 28 p, 5 fig, 5 tab, 3 ref, 3 append.

Descriptors: \*Runoff forecasting, \*Runoff, \*Rivers, \*Watersheds (Basins), Inflow, Low flow, Precipitation (Atmospheric), Reservoirs.
Identifiers: \*USSR, Ukraine, Dnieper River, Ru-

The possibility of applying a method of forecasting runoff by dividing a basin into uniform plots and of using the method for making advance estimates of runoff for various-size rivers is examined. An average plot size of 2,500 sq km, previously used for a basin between the Dnieper River and the Kiev hydroelectric power plant, may be increased to 6,000 and even to as much as 8,000 sq km. A prediction of ten-day low flow 30 days in advance yields positive results only for large basins exceeding 100,000 sq km. Satisfactory predictions of low flow can be made 20 days in advance for basin areas 50,000-100,000 sq km and 10 days in advance for basins between 20,000 and 50,000 sq km. Generally it is possible to make a reliable prediction of minimum daily runoff 10 days in advance and in the case of large basins (100,000 sq km) 20 days in advance. A refining of the method of forecasting water flow to the reservoir of the Kiev power plant by increasing size of runoff plots and by reducing the number of plots used simplifies the work of preparing forecasts for reservoir operation.
(Josefson-USGS)
W71-09127

CALCULATING RAINFALL RUNOFF LOSSES BY PRECIPITATION AND RUNOFF OF SMALL RIVERS USING THE DNIEPER RIVER-RECHITSA BASIN AS AN EXAMPLE (RUS-SIAN: VYCHISLENIYE POTER' DOZH-DEVOGO STOKA PO OSADKAM I STOKU MA-

LYKH REK NA PRIMERE BASSEYNA R. DNEPRA DO G. RECHITSY),

T. I. Meyerson.
In: Problems in Hydrological Forecasting (Voprosy Ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 117-135, 1970. 19 p, 3 fig, 4 tab, 10 ref, append.

Descriptors: \*Rainfall-runoff relationships, \*Precipitation (Atmospheric), \*Runoff, \*Rivers, \*Inflow, Meteorological data, Time lag, Water loss, Streamflow forecasting, Identifiers: \*USSR, Dnieper River, Travel time.

A possibility of calculating rainfall losses of large rivers by the relationship of total runoff of small rivers to precipitation, termed the coefficient of inflow, is examined. In contrast to the runoff coefficient, defined as the ratio of runoff at a basin outlet to precipitation, the inflow coefficient is a more accurate description of losses, since it excludes the ef-fect of transformations of inflow by large rivers. Runoff of the Dnieper River-Rechitsa basin is calculated from actual precipitation and from the in-flow and runoff coefficients, which are determined from the relationships of each of the coefficients to antecedent basin conditions. Flow at the outlet of a large basin, computed by summarizing runoff derived from precipitation data of sub basins, yields better results than computing flow at the outlet of a large basin by application of precipitation data over the large basin. (Josefson-USGS)
W71-09128

A LONG-RANGE FORECAST OF WATER FLOW TO LARGE LAKES OF THE LADOGA BASIN (RUSSIAN: DOLGOSROCHNYY PROGNOZ PRITOKA VODY V KRUPNYYE OZERA LADOZHSKOGO BASSEYNA),

For primary bibliographic entry see Field 04B. W71-09129

STUDY OF THE RELATIONSHIP BETWEEN ANNUAL RUNOFF OF RIVERS OF THE USSR AND ATMOSPHERIC CIRCULATION (RUS-AND AIMOSPHERIC CIRCULATION (ROS-SIAN: ISSLEDOVANIYE ZAVISIMOSTI GODOVOGO STOKA REK SSSR OT AT-MOSFERNOY TSIRKULYATSII), For primary bibliographic entry see Field 02A.

DEPLETION OF STREAMFLOW BY INFIL-TRATION IN THE MAIN CHANNELS OF THE TUCSON BASIN, SOUTHEASTERN ARIZONA, Geological Survey, Washington, D.C. D. E. Burkham.

For sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price \$0.65. Geological Survey Water-Supply Paper 1939-B, 1970. 36 p, 11 fig, 1 plate, 7

Descriptors: \*Ephemeral streams, \*Streambeds, \*Infiltration, \*Streamflow, \*Arizona, Channel morphology, Surface-groundwater relationships, Water yield, Rainfall-runoff relationships, Stream gages, Hydrologic data, Data collections, Mathematical studies, Hydrogeology, Aquifer characteristics, Groundwater recharge, Inflow, Duration

Identifiers: \*Tucson Basin (Ariz), Streamflow depletion, Infiltration rate.

Estimates were made of the average annual volume of infiltration for the period 1936-63 along seven normally dry alluvial channels in the Tucson basin of southeastern Arizona. The essential parts of the method used to estimate infiltration were (1) average relation between rates of inflow and infiltration and (2) flow-duration curves of streamflow. The main channels of the Tucson basin are efficient natural infiltration galleries. The average annual streamflow depletion ranged from about 30 to 90 percent of the average annual inflow to the seven reaches for the period 1936-63. The average an-

## Group 2E—Streamflow and Runoff

nual inflow to all the reaches was about 66,000 acre-feet; of this about 47,000 acre-feet, or 70 percent, was depleted by infiltration, and about 19,000 acre-feet flowed out of the basin. The annual variation in infiltration volumes along the main channels is large and is mainly the result of variation in streamflow. (Woodard-USGS) W71-09139

GRAPHICAL CONVERSION OF A STAGE HYDROGRAPH TO A DISCHARGE HYDRO-

Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics. Leonard F. Konikow.

Journal of Soil and Water Conservation, Vol 26, No 3, p 116-117, May-June 1971. 2 p, 2 fig, 1 tab, 2

Descriptors: \*Stage-discharge relations, \*Data processing, Data collections, Water levels, Discharge (Water), Streamflow, Gaging stations, Stream gages.
Identifiers: \*Rating curves.

A rating curve is used to determine the discharge or extrapolate it for all recorded stream gages. The time spent converting stage to discharge may be shortened considerably by using a transparent overlay with a vertical scale of discharge values cal-culated from the rating curve. When the transparency is placed properly over a completed water-level recorder chart, the stage hydrograph becomes a discharge hydrograph. While this technique is particularly applicable to gaging stations with a stable stage-discharge relationship, a new overlay can easily be prepared if the rating curve shifts. The time and cost to do so is small. (Knapp-USGS) W71-09275

THE OFFSET COURSE OF THE ST. JOHNS

RIVER, FLORIDA, North Carolina Univ., Chapel Hill. For primary bibliographic entry see Field 02J. W71-09309

A STUDY OF PRECIPITATION, STREAM-FLOW, AND WATER USAGE ON THE UPPER

RIO GRANDE, Environmental Science Services Admin., El Paso, Tex.; and Bureau of Reclamation, El Paso, Tex. For primary bibliographic entry see Field 02A. W71-09310

ESTIMATING MEAN-ANNUAL RUNOFF USING CHANNEL EOMETRY MEASURE-

Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 04A.

A PROPOSED STREAMFLOW DATA PRO-

GRAM FOR UTAH, Geological Survey, Salt Lake City, Utah. For primary bibliographic entry see Field 07A.

PRELIMINARY REPORT ON WIND-TIDE FLOODING IN NEW HANOVER COUNTY, NORTH CAROLINA.
Corps of Engineers, Wilmington, N.C.

For primary bibliographic entry see Field 04A.

SPECIAL FLOOD HAZARD INFORMATION REPORT ON ECONLOCKHATCHEE RIVER. ORANGE AND SEMINOLE COUNTIES. FLORIDA.

Corps of Engineers, Jacksonville, Fla. For primary bibliographic entry see Field 04A. W71-09339

RIVER RUNOFF - THEORY AND ANALYSIS, D. L. Sokolovskii.

Available from the National Technical Information Service as TT70-50058, \$3.00 in paper copy, \$0.95 in microfiche. Jerusalem, Israel Program for Scientific Translations, 1971. 3d ed. 489 p.

Descriptors: \*Stage-discharge relations, \*Rainfall-runoff relationships, \*Runoff forecasting, \*Stream-flow forecasting, \*Water balance, Mathematical models, Hydrogeology, Water management (Ap-plied), Systems analysis, Runoff, Streamflow, Lakes, Hydrology, Evapotranspiration, Statistical methods, Peak discharge, Low flow, Flood forecasting, Sediment discharge, Sediment trans-port, Silting, Computer programs. port, Silting, Computer programs. Identifiers: \*River runoff analysis.

This book, which deals with fundamentals of river runoff theory and with practical methods for computing characteristics of average annual runoff and its long-term distribution, seasonal distribution of runoff, maximum runoff of spring and rainfall floods, sediment discharge, and other characteristics of river hydrology, is intended for students studying hydrometeorology and geography. It may also serve as a theoretical and practical handbook for hydrological engineers, hydraulic engineers and other specialists dealing with the design and opera-tion of water management structures. This edition differs from the first two editions (published in 1952 and 1959) by the inclusion of numerous changes and additions reflecting modern achievements in hydrology and requirements for hydrology and for runoff computations. Sections are included on the basic concepts of probability theory, determination of the long-term average groundwater flow of USSR rivers, methods for investigating patterns of annual runoff fluctuations, use of tronic analog computers in flood computations, the unit hydrograph method, hydrological and hydrometeorological computations in the design of irrigation systems, and methods for calculating maximum stages. (Knapp-USGS)

#### 2F. Groundwater

DISPERSION IN HETEROGENEOUS NONU-NIFORM ANISOTROPIC POROUS MEDIA,

Purdue Univ., Lafayette, Ind. School of Chemical Engineering.

For primary bibliographic entry see Field 05B. W71-09079

STUDIES OF INTER-PARTICLE VOID CHARACTERISTICS,

For primary bibliographic entry see Field 08D. W71-09082

GEOLOGY AND GROUNDWATER RESOURCES OF TRAILL COUNTY: PART 3

GROUNDWATER RESOURCES, Geological Survey, Bismark, N. Dak. H. M. Jensen, and R. L. Klausing.

North Dakota Geological Survey Bulletin 49 and North Dakota Water Commission County Groundwater Studies 10, 1971. 40 p, 13 fig, 1 plate, 2 tab, 28 ref, append.

Descriptors: \*Groundwater, \*Water resources development, \*Hydrologic data, \*Aquifer characteristics, \*North Dakota, Water wells, Hydrogeology, Water sources, Aquifers, Geology, Water table, Water levels, Water yield, Water level fluctuations, Water utilization, Water quality, Chemical analysis Precipitation, Atmospheric, Development sis, Precipitation (Atmospheric), Data collections. Identifiers: \*Groundwater resources, \*Traill County (N Dak).

Groundwater in Traill County is obtainable from sand and gravel deposits associated with the glacial drift of Pleistocene age and from sand and (or) sandstone beds in the Dakota Group of Late Cretaceous age. The principal aquifers are the Dakota, Hillsboro, Galesburg, Elk Valley, and

Belmont aquifers. The Dakota aquifer, which is the Belmont aquifers. The Dakota aquifer, which is the largest and most productive aquifer in the county, yields more than a million gallons of highly mineralized water per day. The water may be either a sodium sulfate or sodium chloride type; however, sodium sulfate is the predominant water type. The dissolved-solids content of 29 samples of water ranged from 1,990 to 5,710 ppm and averaged 3,790 ppm. Sulfate content ranged from 355 to 3,220 ppm and averaged 1,320 ppm. The Hillsboro and Galesburg aquifers offer the most potential for future development. Individual well yields from the Hillsboro and Galesburg aquifers may be as much as 500 and 250 gallons per minute, respectively. as 500 and 250 gallons per minute, respectively.

Aquifers of less importance are present in the glacial drift, but they are relatively thin and of small areal extent. These aquifers yield adequate supplies of water for average domestic and livestock uses. (Woodard-USGS) W71-09090

RESULTS OF A STUDY OF ORGANIC MATTER IN GROUNDWATERS OF KAMCHATKA (Russian: Rezul'taty izucheniya organicheskikh veshchestv v podzemnykh vodakh Kamchatki), All-Union Scientific Research Inst. of Hydrogeolo-

gy and Engineering Geology, Moscow (USSR). For primary bibliographic entry see Field 02K. W71-09099

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY: APPENDIX D - GEOLO-GY AND GROUND WATER (FINAL DRAFT), Geological Survey, Arlington, Va. and Geological Survey, Hartford, Conn. For primary bibliographic entry see Field 03B. W71-09106

RECORDS OF PRECIPITATION, LEVELS AND GROUNDWATER RECHARGE TO THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1970,

Geológical Survey, San Antonio, Tex. Celso Puente.

Edwards Underground Water District Bulletin 27 (Texas), Apr 1971. 11 p, 4 tab, 12 ref.

Descriptors: \*Groundwater, \*Hydrogeology, \*Aquifer characteristics, \*Water levels, \*Texas, \*Groundwater, Precipitation (Atmospheric), Groundwater recharge, Groundwater movement, Aquifers, Storage, Streamflow, Flow rates, Rainfall-runoff relationships, Surface-groundwater relationships, Water level fluctuations, Hydrologic data. Identifiers: \*Groundwater resources

Records of precipitation, water levels, and estimates of recharge to the Edwards and associated limestones in the San Antonio, Texas area during 1970 are summarized. Rainfall for 1970 was below average throughout most of the recharge area. The water levels fluctuated just below the record high, owing to recharge from high flood runoff during intense storms. Groundwater storage in the Edwards Limestone remained above average during 1970. The estimated recharge was 661,600 acre-feet, which is about 30 percent above the average recharge for the period 1934-69. (Woodard-USGS) W71-09111

HEAT TRANSFER MEASUREMENT IN A GEOTHERMAL AREA,

National Research Center for Disaster Prevention. Tokyo (Japan).

Kozo Yuhara

Tectonophysics, Vol 10, No 1-3, p 19-30, 1970, 12 p, 7 fig, 4 tab, 8 ref.

Descriptors: \*Geysers, \*Heat flow, \*Heat transfer, Mass transfer, Hot springs, Geothermal studies, Boiling, Convection, Cooling, Heat balance, Heat budget, Steam. Identifiers: \*Geothermal areas, \*Japan.

In Japan, there are about twenty geothermal areas, where heat is transferred by fumaroles, steam wells, hot springs, steaming grounds, evaporation from hot pools and thermal conduction through the earth. Methods of heat transfer measurement used at Owakudani and Sounzan geothermal areas of Hakone Volcano are outlined. Total mass discharge from these areas amounts to 129 kg/sec and total heat transfer amounts to 10.64 million cal./sec. Heat transferred from all geothermal areas of Japan may be estimated roughly to be 2 times 10 to the 23rd power erg/year. Adding to this the energy released by volcanic activity, hot springs, and the normal heat flow of non-volcanic regions, the total energy released from the whole of Japan, exclusive of that by earthquakes is about 9 times 10 to the 24th power erg/year. (Knapp-USGS) W71-09117

HEAT FLOW FROM NATURAL GEYSERS, ESSA Research Labs., Boulder, Colo.; and Colorado Univ., Boulder. Dept. of Mechanical En-

gineering. John Rinehart.

Tectonophysics, Vol 10, no 1-3, p 11-17, Sept 1970. 7 p, 5 fig, 7 ref.

Descriptors: \*Geysers, \*Heat flow, \*Heat transfer, Mass transfer, Hot springs, Geothermal studies, Boiling, Convection, Cooling, Heat balance, Heat budget, Steam.

Identifiers: \*Geothermal areas.

A natural geyser is a mechanism that extracts heat from the earth. Trapped meteoric water is heated and then thrown clear of its reservoir as hot water or steam, carrying heat with it. There are two basic types of geysers: Columnar, discharging quantities of hot water; and pool, in which the eruption consists of a series of detonating steam explosions. Results of temperature measurements made deep within several geysers permit calculation of their respective approximate rates of heat extraction. Old Faithful, which discharges large quantities of water, extracts heat at the approximate rate of 1.34 water, extracts neat at the approximate rate of 1.34 million cal./sec. Narcissus, an explosive type geyser, develops power at the approximate rate of 3.3 thousand cal./sec, and Solitary, another explosive geyser, at the rate of 6.4 thousand cal./sec. (K-napp-USGS)
W71-09118

GOUNDWATERS OF THE MANGYSHLAK-UST URT OIL-AND GAS-BEARING REGION (RUS-SIAN: PODZEMNYYE VODY MANGYSHLAK-USTYURTSKOY NEFTEGAZONOSNOY PROVINTSII),

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-

stitut Gidrogologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W71-09135

A PRELIMINARY EVALUATION OF BANK STORAGE ASSOCIATED WITH LIBBY RESER-VOIR IN NORTHWESTERN MONTANA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 03B. W71-09137

GROUNDWATER DATA AS OF 1967--COLORADO DESERT SUBREGION, CALIFOR-

Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 07C. W71-09142

SUMMARY OF THE GROUNDWATER DATA AS OF 1967-CALIFORNIA REGION, Geological Survey, Menlo Park, Calif. Water

Resources Div.

J. S. Bader. Geological Survey Open-file Report, July 24, 1969. 32 p, 10 fig, 11 ref.

Descriptors: \*Groundwater, \*Water wells, \*Hydrologic data, \*Aquifer characteristics, \*California, Water table, Water levels, Reviews, Observation wells, Specific capacity, Withdrawal, Groundwater recharge, Water temperature, Water yield, Water quality, Chemical analysis, Dissolved solids, Aquifers.

Identifiers: \*Groundwater data (Calif).

The groundwater data for the 11 hydrologic subregions of the California Region are summarized.

Data for the observation wells include basin name, area of basin, depth to water in feet below land-surface datum, storage capacity, range of tempera-ture, range of dissolved solids, and withdrawal capacity. Summaries for the Delta-Central Sierra Subregion, the Tulare Basin Subregion, and the San Joaquin Basin Subregion are combined. In addition to this report, the Geological Survey has prepared a series of nine reports for the 11 subregions. Each report contains data in a more complete form and an extensive list of publications by the U.S. Geological Survey and the California Department of Water Resources. (Woodard-USGS) W71-09143

# GROUNDWATER DATA AS OF 1967--NORTH COASTAL SUBREGION, CALIFORNIA, Geological Survey, Menlo, Calif. Water Resources

For primary bibliographic entry see Field 07C. W71-09144

GROUNDWATER DATA AS OF 1967--SOUTH LAHONTAN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 07C. W71-09145

GROUNDWATER DATA AS OF 1967--NORTH LAHONTAN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 07C.

GROUNDWATER DATA AS OF 1967-SAN JOAQUIN BASIN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 07C. W71-09147

W71-09146

GROUNDWATER DATA AS OF 1967--SACRA-MENTO BASIN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 07C. W71-09148

#### WATER LEVELS IN CARBONATE ROCK TER-RANES.

Geological Survey, Raleigh, N.C.; and Geological Survey, Washington, D.C. Water Resources Div. Harry E. Le Grand, and V. T. Stringfield. Ground Water, Vol 9, No 3, p 4-10, May-June 1971. 7 p, 3 fig, 16 ref.

Descriptors: \*Water levels, \*Hydrogeology, \*Groundwater movement, \*Water level fluctuations, \*Karst, Limestones, Fissures (Geology), Permeability, Infiltration, Percolation, Water table, Topography, Climates, Springs, Water wells, Water yield, Water circulation, Carbonate rocks. Identifiers: \*Solution channels (Karst).

The depth to the water table in carbonate rocks is controlled by local factors such as permeability and topography and by the regional factor of climate; both permeability and topography are dynamically developed according to the degree of preferential circulation of subsurface water and of solution of the rock. The water table responds by lying deep beneath hilly permeable karstlands and shallow beneath flat and poorly permeable carbonate

rocks. The uneven distribution of permeability and of topographic conditions is responsible for the karst phenomena of disappearing and reappearing surface streams. Great infiltration capacities of some karst regions result in large local fluctuations some cases in local rever-sals in direction of groundwater flow between wet and dry seasons. Water-level behavior in space and time is a primary consideration for interpreting the hydrology of carbonate terranes. (Knapp-USGS) W71-09299

# OBSERVATIONS ON WATER CONTENT CHANGES IN STRATIFIED SEDIMENTS DURING PIT RECHARGE,

Arizona Water Resources Research Center, Tuc-

For primary bibliographic entry see Field 04B. W71-09301

# PHREATIC VERSUS VADOSE METEORIC DIAGENESIS OF LIMESTONES: EVIDENCE FROM A FOSSIL WATER TABLE, Texas Univ., Austin. Dept. of Geological Sciences. For primary bibliographic entry see Field 02J.

# HYDRAULIC TESTING OF WELL HTH-23 IN CENTRAL NEVADA, Geological Survey, Denver, Colo. George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-23 (AEC), (Central Nevada-32), June 1970. 34 p, 22 fig, 1 tab, 1 ref. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Ob-servation wells, Tracers, On-site tests. Identifiers: Aquifer testing, Well testing, Pumping

An analysis is presented of data obtained during hydraulic tests in hydrologic test hole HTH-23, Little Smoky Valley, Nevada. The analysis focused primarily on determining transmissivity of selected intervals within the zone of interest. Further analysis is concerned with determining variations in hydraulic potential in the vertical section and transmissivity, hydraulic conductivity, storage coeffi-cient, and velocity of groundwater movement. Hole HTH-23 penetrated alluvium, welded tuff, and tuffaceous sediments. The composite water level for the interval from 1,337.6 to 2,285.9 m was 138.8 m below land-surface datum. Transmissivity ranged from an estimated 0.00062 to 5.8 cubic meters per day per meter; hydraulic conductivity ranged from an estimated 0.0000084 to 0.15 cubic meters per day per square meter; and velocity was as high as 0.0045 meters per day. Velocities of groundwater movement through some intervals might be significantly greater. (See also W71-09325 thru W71-0931) (Knapp-USGS) W71-09324

## HYDRAULIC TESTING OF WELL HTH-4 IN CENTRAL NEVADA, Geological Survey, Denver, Colo.

George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-31 (AEC), (Central Nevada-34), June 1970. 21 p, 10 fig, 1 tab, 2 ref. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.
Identifiers: Aquifer testing, Well testing, Pumping

An analysis is presented of data obtained during hydraulic tests in hydrologic test in hydrologic test hole NTH-4, Little Smoky Valley, Nevada. The

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analysis is focused primarily on determining varia-tions in hydraulic potential in the vertical section and transmissivity, hydraulic conductivity, storage coefficient, and velocity of groundwater move-ment. Hole HTH-4 penetrated alluvium, rhyolite, and welded tuff. The composite water level was 157.5 m below land-surface datum. Transmissivity ranged from an estimated 0.0073 to 7.3 cubic meters per day per meter; hydraulic conductivity ranged from an estimated 0.0008 to 0.8 cubic meters per day per square meter; and velocity ranged from an estimated 0.00032 to 0.019 meters per arom an estimated 0.00032 to 0.019 meters per day. However, all of these values probably are low. During the cementing process, drilling mud and cement were forced into the water-bearing fractures and effectively sealed them from the borehole. (See also W71-09324) (Knapp-USGS) W71-09325

#### HYDRAULIC TESTING OF WELL HTH-3 IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. George A. Dinwiddie. Geological Survey Open-file Report USGS-474-34 (AEC), (Central Nevada-35), June 1970. 24 p, 12 fig, 1 tab, 2 ref. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.

Identifiers: Aquifer testing, Well testing, Pumping

An analysis is presented of data obtained during hydraulic tests in hydrologic test hole NTH-3, Lit-tle Smoky Valley, Nevada. The analysis is focused primarily on determining variations in hydraulic potential in the vertical section and transmissivity, hydraulic conductivity, storage coefficient, and velocity of groundwater movement in selected in-tervals of anticipated high permeability. Hole HTH-3 penetrated alluvium, tuff, and tuffaceous sandstone and claystone. The composite water level for the interval from 1,431.6 to 1,831.5 m was 172.67 m below land-surface datum. In the tested intervals from which the data were adequate for analysis, transmissivity ranged from 0.97 to 2.9 cubic meters per day per meter; hydraulic conductivity ranged from 0.01 to 0.23 cubic meters per day per square meter; and velocity ranged from 0.002 to 0.046 meters per day. (See also W71-09324) (Knapp-USGS) W71-09326

# HYDRAULIC TESTING OF WELL HTH-5 IN

CENTRAL NEVADA, Geological Survey, Denver, Colo. George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-39 (AEC), (Central Nevada-37), June 1970. 15 p, 5 fig, 1 tab, 1 ref. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.

Identifiers: Aquifer testing, Well testing, Pumping

An analysis is presented of data obtained during hydraulic tests in hydrologic test hole HTH-5, Hot Creek Valley, Nevada. Data collection was focused primarily on determining variations in hydraulic potential in the vertical section and permeability of the most transmissive intervals. Hole HTH-5 penetrated alluvium, tuffaceous sandstone and siltstone, and welded tuff with thin intervals of bedded tuff. The composite water level with the hole open from 635.2 to 1,830.8 m and with the casing per-forated in two intervals from 173.7 to 179.8 m and from 536.4 to 551.7 m was 35.1 m below land-surface datum. In the tested intervals from which the data were adequate for analysis, static water levels ranged from 38.42 m below land-surface datum to

136.5 m above land-surface datum and relative specific capacities ranged from an estimated 0.00006 to 0.18 cubic meters per day per meter of drawdown. (See also W71-09324) (Knapp-USGS) W71-09327

# HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-1, IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. George A. Dinwiddie.

Geological Survey Open-file Report USGS 474-77 (AEC), (Central Nevada-7), June 1970. 25 p, 12 fig, 1 tab. USAEC Contract No AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Ob-servation wells, Tracers, On-site tests. Identifiers: Aquifer testing, Well testing, Pumping

Hydraulic testing and sampling of hole Ue-1 for the U.S. Atomic Energy Commission's underground on January 31, 1967, and ended on February 13, 1967. Depth intervals tested and sampled were: zone 1, 1,710 feet to total depth; zone 2, 1,508 to 1,706 feet; zone 3, 1,266 to 1,464 feet; zone 4, 788 to 986 feet; and zone 5, 400 to 598 feet. Injection and recovery tests were run on each death interval. and recovery tests were run on each depth interval. Relative specific capacities calculated from injection data were much smaller than those calculated from recovery data. Mud and lost circulation material in the hole and in the formation during the injection test account for the different relative specific capacities. Comparative composite hydrostatic heads before and after the injection and recovery tests were 211.5 feet below land-surface datum and 218.0 feet below lsd. The difference may be due to differences in the conditions of the surements. (See also W71-09324) (Knapp-USGS) W71-09328

#### HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-2, IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-78 (AEC), (Central Nevada-8), June 1970. 23 p, 11 fig, 1 tab. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.

Identifiers: Aquifer testing, Well testing, Pumping

Hydraulic testing and sampling of hole Ue-2 for the U.S. Atomic Energy Commission's underground on January 16, 1967, and ended on January 22, 1967. Seven depth intervals, beginning at 434 feet and extending to total depth, were tested and sampled. Injection tests were run on all depth intervals; recovery tests were run on intervals 2 through 7. In only one interval (zone 4) was the recovery-test curve suitable for determining relative specific capacity. In the zone, relative specific capacity calculated from recovery data was much less than that calculated from injection data. The composite hydrostatic head before and after injection and recovery tests was 579.6 feet below land-surface datum. In all zones where the static water level was measured after injection and then after swabbing (zones 3, 5, 6, and 7) the static water level changed after swabbing. (See also W71-09324) (Knapp-W71-09329

# HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-3, IN CENTRAL NEVADA, Geological Survey, Denver, Colo. George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-79 (AEC), (Central Nevada-9), June 1970. 21 p, 11 fig. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igeneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests. Identifiers: Aquifer testing, Well testing, Pumping

Hydraulic testing and sampling of hole Ue-3 for the Hydraulic testing and sampling of note Ue-3 for the U.S. Atomic Energy Commission's underground nuclear testing program in Central Nevada began on February 11, 1967, and ended on February 19, 1967. Depth intervals tested were: zone 1, 1,492 feet to total depth; zone 2, 1,310 to 1,488 feet; zone 3, 1,004 to 1,182 feet; zone 4, 865 to 1,043 feet; zone 5, 610 to 788 feet; and zone 6, surface to 400 feet. Permeability of zones 3, 4 and 5 is high whereas permeability of zone 1 is low. Mud in the borehole made a pretest determination of the composite hydrostatic head impossible. After testing, the static water level was 238.13 feet below land-surface datum. (See also W71-09324) (Knapp-USGS) W71-09330

#### **HYDRAULIC TESTING OF WELL HTH-21-1 IN** CENTRAL NEVADA,

Geological Survey, Denver, Colo.

George A. Dinwiddie.

Geological Survey Open-file Report USGS-474-81 (AEC), (Central Nevada-22), June 1970. 34 p, 23 fig, 1 tab, 1 ref. USAEC Contract AT (29-2)-474.

Descriptors: \*Hydrogeology, \*Aquifers, \*Igneous rocks, \*Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Ob-servation wells, Tracers, On-site tests. Identifiers: Aquifer testing, Well testing, Pumping

An analysis is presented of data obtained during hydraulic tests in hydrologic test hole HTH-21-1, Little Smoky Valley, Nevada. The analysis is focused primarily on determining transmissivity of selected intervals within the zone of interest. Further analysis is concerned with determining variations in hydraulic conductivity, storage coeffi cient, and velocity of groundwater movement in selected intervals of the entire hole. Hole HTH-21-1 penetrated alluvium, tuff, and tuffaceous sediments. The composite water level was 151.56 m below land-surface datum. In the tested intervals from which the data were adequate for analysis, transmissivity ranged from an estimated .000014 to 23.1 cubic meters per day per meter. (See also W71-09324) (Knapp-USGS) W71-09331

#### FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, HURON RIVER, NORWALK CREEK. OHIO.

Corps of Engineers, Buffalo, N. Y. For primary bibliographic entry see Field 04A. W71-09337

#### 2G. Water in Soils

DISPERSION IN HETEROGENEOUS NONU-NIFORM ANISOTROPIC POROUS MEDIA, Purdue Univ., Lafayette, Ind. School of Chemical Engineering.

For primary bibliographic entry see Field 05B. W71-09079

# PRECIPITATION, ITS CHEMICAL COMPOSITION AND EFFECT ON SOIL WATER IN A BEECH AND A SPRUCE FOREST IN SOUTH SWEDEN,

Lund Univ. (Sweden). Dept. of Plant Ecology For primary bibliographic entry see Field 02K. W71-09081

# BEHAVIOR OF POROUS BED NEAR FLOW

SINGULARITY,
Karlsruhe Univ. (West Germany). Institut fuer
Hydromechanik, Straunanlagen and Wasserversorgung; and Georgia Inst. of Technology, Atlanta.
School of Civil Engineering.

ASCE Proceedings, Journal of the Soil Mechanics and Foundations Division, Vol 97, No SM-2, Paper 7935, p 393-415, Feb 1971. 23 p, 16 fig, 6 tab, 10 ref, 4 append. USN - Bur of Ships. Contract Nobs - 84237.

Descriptors: \*Flow resistance, \*Beds, \*Porous media, \*Soil mechanics, Fluid mechanics, Analytical techniques, Model studies, Theoretical analysis, Sands, Seepage, Hydraulic gradient, Heaving, Flow rates, Boundaries (Surfaces), Flow separation, Mathematical studies.

Identifiers: \*Orthogonality, Boiling, Piping.

The behavior of a porous bed in the vicinity of a flow singularity that was imposed by the nonorthogonality of a potential line and a streamline was studied theoretically and experimentally. Flow of water under a circular cylinder that is partially imbedded in sand results in nonorthogonality at the intersection of sand and cylinder unless the cylinder is half imbedded. The seepage force can be theoretically infinite at the singular point. Experiments were conducted that led to boiling, heaving, and piping for the partially-imbedded cylinder. Results of the experiment indicate that the flow singularity of nonorthogonality is not very serious because nature apparently corrects for this anomaly by a readjustment of flow in the vicinity of the singularity. Furthmore, a more detailed investiga-tion of the analytical solution in the vicinity of the singularity shows that, if the hydraulic gradient is evaluated in terms of the sand diameter in the vicinity of singularity point, the seepage force may not actually be very large. (Woodard-USGS) W71-09108

# SOLUTES IN PRESSURE MEMBRANE FIL-TRATES OF SEVERAL CLAY-WATER-ELEC-TROLYTE SYSTEMS, North Carolina State Univ., Raleigh. Dept. of Soil

Science

James Burton Hart Jr.

Ph D Thesis, North Carolina State University, 1970. 109 p. 13 fig, 24 tab, 106 ref. OWRR Project A-008-NC (4).

Descriptors: \*Soil water movement, \*Clays, \*Soil pressure, \*Water chemistry, \*Diffusion, Ion exchange, Filtration, Model studies, Hydrogeology, Analytical techniques, X-ray diffraction, Clay minerals, Chemical analysis, Soil water. Identifiers: \*Soils (Pressure filtration).

Evaluation is made of the composition of solutions forced out of clay suspensions by pressure differentials applied in a conventional pressure membrane apparatus and a standardized filtration technique. Suspensions studied include Ca-saturated kaolinite and Na- and Ca-saturated montmorillonite suspended in water or 0.1 N chloride salts of the respective saturating cations. Specifically, the purpose was to determine the concentration of cations (Na or Ca) and anions (Cl) in filtrates extracted at various pressures, and the extent to which the clay suspensions released other components (including H, OH, Si, and Al species) during extraction. A series of clay-water-electrolyte suspensions were prepared, characterized, and subjected to successive pressure increments. The filtrates were collected, analyzed, and evaluated with respect to solute composition and the chemical stability of the clays in the suspensions. The water retained by the clays decreased in the order Namontmorillonite, Ca-montmorillonite, and Ca-kaolinite for the initial pressures and tended to decrease to a common level at the final pressure. (Woodard-USGS) W71-09116

DEPLETION OF STREAMFLOW BY INFIL-TRATION IN THE MAIN CHANNELS OF THE TUCSON BASIN, SOUTHEASTERN ARIZONA,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02E. W71-09139

#### CONSOLIDATION CHARACTERISTICS OF SOME PLEISTOCENE PERIGLACIAL METASTABLE SOILS OF EAST KENT, Imperial Coll. of Science and Techology, London

(England). Dept. of Geology.
Peter George Fookes, and Robert Best.

Quarterly Journal of Engineering Geology, Vol 2, No 2, p 103-127, Dec 15, 1969. 25 p, 12 fig, 2 tab,

Descriptors: \*Loess, \*Aeolian soils, \*Soil stability, \*Consolidation, Soil physical properties, Slope sta-bility, Soil strength, Soil mechanics. Identifiers: Kent (U.K.).

Metastable partially saturated soils are those which on wetting under load undergo a sudden decrease of void ratio and structural collapse. One of the most important soils of this group is loess, a silty quartzose sediment of uniform grading. This paper deals principally with the geotechnical and mineralogical characteristics of east Kent (U.K.) loess. A coarser grained poorly sorted glacial solifluxion soil from Kent was also examined and found to be metastable. Because material of this type is fairly common this observation could have significant engineering implications. (Knapp-USGS) W71-09140

## A MODEL STUDY OF THE SQUEEZING OUT OF INTERSTITIAL WATERS, (Russian: K voprosu ob izuchenii na modelyakh protsessa otzhatiya sedimentatsionnykh vod), Institut Prirodnogo Gaza, Moscow (USSR).

V. L. Sokolov, and V. F. Simonenko. Akademiya Nauk SSSR Izvestiya, Seriya Geologicheskaya, No 3, p 117-121, Mar 1971. 5 p, 1 fig, 19 ref.

Descriptors: \*Model studies, \*Connate water, \*Geochemistry, \*Hydrodynamics, Loads (Forces),
Pressure, Compaction, Water properties, Clays,
Diagenesis, Sediments, Lithification, Organic
matter, Electrolytes.
Identifiers: \*USSR, \*Black Sea, Mineralization,

Hydrocarbons, Geostatic pressure, Plastic flow.

The squeezing out of interstitial waters from sinking clay strata is a continuous process within a very wide range of depths, including the catagenetic zone. The process, which begins at the first stages of compaction and mineralization, parallels thermocatalytic transformation of organic matter by stimulating the initial migration of hydrocarbons. Black Sea muds were squeezed from 25 to 8,000 kg/sq cm, with a smoothly increasing load, for 38 days. The amount of squeezed-out interstitial water varies with compression rate at constant temperature and pressure. The remaining moisture after rapid compression is 9% and after slow compression, 2.8%. With rapid increases in load, some of the water cannot be squeezed out completely; the boundary of complete squeezing out of interstitial water from a sinking sediment may be quite deep. Assuming that the end of the squeezing out of interstitial waters takes place with a differential pressure of the order of 200 atm, the boundary of complete squeezing out of interstitial waters should be at a depth of about 4,000 m. (Josefson-USGS) W71-09277

#### EFFECT OF CLAY ON THE ACCURACY OF THE HYDROMETER METHOD, Indian Inst. of Tech., Kanpur. Dept. of Civil En-

gineering. For primary bibliographic entry see Field 07B. W71-09284

SOIL: A NATURAL SINK FOR CARBON MONOXIDE, Stanford Research Inst., Irvine, Calif.

Robert E. Inman, Royal B. Ingersoll, and Elaine A.

Supported by Environmental Protection Agency and the Coordinating Research Council Science, Vol 172, No 3989, p 1229-1231, June 18, 1971. 3 p, 2 fig, 11 ref.

Descriptors: \*Soil physics, \*Gases, \*Air environment, \*Soil microogranisms, \*Air pollution, Fallout, Soil chemistry, Application method.
Identifiers: \*Carbon monoxide, \*Natural sinks (Gases).

The role of the soil as a natural sink into which carbon monoxide can readily disappear from the earth's atmosphere is described on the basis of measurements made on soil samples from California, Florida, and Hawaii. Most of the soils showed a surprising capability to remove CO from the test atmospheres. A plotting soil mixture depleted CO in a test atmosphere from a concentration of 120 ppm to near zero within 3 hours. Maximum activity occurred at 30 deg C. Steam sterilization of the soil, the addition or antibiotics or 10% (by weight) saline solution, and anaerobic conditions all prevented carbon monoxide intake. Sterilized soil inoculated with nonsterile soil acquired activity with time. Samples of various natural soils differed in their ability to remove CO from the air. Acidic soils with a high content of organic matter were the most active. Soil ability to remove CO from the atmosphere is ascribed to the activity of soil microorganisms. Average soil activity tested (8.44 mg of CO per hr per sq meter of soil) is equivalent to 191 metric tons per year sq mi, which is 6.5 times the annual estimated production of CO in the United States. The soil is thus a major natural sink for CO that is released into the air by nature or by the burning of fossil fuels. (Lang-USGS) W71-09297

#### 2H. Lakes

Lake Powell Quality Studies for the Navajo Plant, Bechtel Inc., San Francisco, Calif; and Arizona State Univ., Tempe. For primary bibliographic entry see Field 05C. W71-09051

#### ISOLATION AND IDENTIFICATION STEROLS FROM A PLEISTOCENE SEDIMENT, California Univ., Berkeley. Dept. of Chemistry. William Henderson, Walter E. Reed, Gordon Steel, and Melvin Calvin.

Nature, Vol 231, No 5301, p 308-309, June 4, 1971. 2 p, i fig, I tab, II ref. Supported by NASA.

Descriptors: \*Sedimentology, \*Surface waters, \*Sediments, \*Dating, \*Geologic time, Analytical techniques, Instrumentation, Gas chromatography, Spectrometers, Biological properties, California. Identifiers: \*Sterols, \*Pleistocene sediment, Mono

Analysis of sediments for relatively unaltered molecules such as sterols which are present in sea water, bottom muds (both marine and nonmarine), surface soils, and an Eocene shale is discussed. Sediments deposited in Mono Lake, California show no clearly freshwater fauna but contain an abundance of algal debris, diatoms, ostracods, and, locally, gastropods. The sediment analyzed contained alternate bands of algal silt and diatomite. It resides within a complete Pleistocene lacustrine sequence and its position within that sequence (that is, 80 m below the top of the Wilson Creek Formation, which is the latest Pleistocene sediment exposed in the Mono Basin) suggests an age about 130,000 yr. (Woodard-USGS) W71-09095

## Group 2H-Lakes

EUTROPHICATION OF SHELTERED BAYS IN A LARGE LAKE, Ultah State Univ., Logan. Center for Water

Resources Research.
For primary bibliographic entry see Field 05C.
W71-09150

A GUIDE TO AQUATIC SMARTWEEDS (POLYGONUM) OF THE UNITED STATES, Virginia Polytechnic Inst., and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 05G. W71-09151

# LIMNOLOGY OF LAKE CHAMPLAIN: 1965-

1970, Vermont Univ., Burlington. Dept. of Zoology. E. B. Henson, and Milton Potash.

Available from the National Technical Information Service as PB-200 261, \$3.00 in paper copy, \$0.95 in microfiche. Vermont Water Resources Research Institute, Completion Report, Dec 1970. 23 p, 8 ref, 9 theses. OWRR Project A-001-VT (4).

Descriptors: \*Limnology, \*Lakes, \*Eutrophication, Water pollution effects, Thermal properties, Chemical properties, Conductivity, Nutrients, Heavy metals, Zooplankton, Benthos, Periphyton, Amphipoda, Diptera, Snails, Mayflies, Midges, Mussels, Seston, Hydrology, Meteorology, Optical properties, Currents (Water), Vermont. Identifiers: \*Lake Champlain (Vt), Baseline information, Morphometry, Water budget, Cations.

This five year study assembled information on physical, chemical, and biological characteristics of Lake Champlain, Vermont, one of the largest and deepest lakes of the USA. The determinations included currents of the lake, water thermal and optical features, alkalinity, pH value, selected cations, dissolved oxygen, nitrates, phosphates, mercury, lead, phytoplankton, zooplankton, micro- and macro-benthos, colonization of shorelines, Polychaeta worms, and seston content. (Wilde-Wisconsia) Wisconsin) W71-09152

# **OXYGEN PRODUCTION IN SOME NORTHERN**

INDIANA LAKES,
Manchester Coll., North Manchester, Ind. Dept. of Biology.

For primary bibliographic entry see Field 05C. W71-09153

#### TENTH INTERNATIONAL MICROBIOLOGICAL CONGRESS, (In Russian), E. N. Mishustin.

Izvestiva Akademii nauk Biologicheskaya, No 1, p 153-158, 1971.

Descriptors: \*Microorganisms, \*Foreign research, \*Conferences, Water purification, Mexico, Sea water, Fresh water, Impoundments, Aquatic plants, Aquatic animals, Microbiology. Identifiers: Tenth Microbiological Congress.

The 10th International Microbiological Congress held in Mexico City during August 9-15, 1970, was attended by more than 1,000 scientists from different parts of the world. The program embraced the general microbiology, taxonomy, genetics, agricultural microbiology, and technical microbiology. Special session was dedicated to microorganisms of seas and freshwater basins. In discussion of water-inhabiting saprophytic and autotrophic microorganisms attention was given to processes taking place in purification of water reservoirs. The participants decided to replace in the future the general congresses by meetings of narrower divisions, such as bacteriology, mycology, and virology. (Wilde-Wisconsin) W71-09161

UTILIZATION OF HERBIVOROUS FISH IN FISH MANAGEMENT AND MELIORATION OF WATER BASINS, (IN RUSSIAN).
For primary bibliographic entry see Field 05G. W71-09163

# HYPNODINIUM-LIKE ALGAL BLOOMS IN GEORGIA LAKES,

Georgia State Univ., Atlanta. Dept. of Biology; and Georgia Water Quality Control Board, Atlanta. For primary bibliographic entry see Field 05C. W71-09173

PRODUCTION, MINERAL NUTRIENT ABSORPTION, AND BIOCHEMICAL ASSIMILATION BY JUSTICIA AMERICANA AND ALTERNANTHERA PHILOXEROIDES, Auburn Univ., Ala. Agricultural Experiment Stations

For primary bibliographic entry see Field 05C. W71-09178

A PLASTIC BARRIER FOR SPOT TREATMENT OF AQUATIC VEGETATION, Texas Parks and Wildlife Dept., Waco. For primary bibliographic entry see Field 05C. W71-09179

PATHWAYS OF TRACE ELEMENTS IN ARC-TIC LAKE ECOSYSTEMS. PROGRESS RE-PORT, APRIL 15, 1970-APRIL 14, 1971, Alaska Univ., College. Inst. of Marine Sciences. For primary bibliographic entry see Field 05C. W71-09190

#### ASYMMETRY OF THE INTERNAL SEICHE IN LOCH NESS.

National Inst. of Oceanography, Wormley (England).

S. A. Thorpe. Nature, Vol 231, No 5301, p 306-308, June 4, 1971.3 p, 3 fig, 13 ref.

Descriptors: \*Seiches, \*Water circulation, \*Surface waters, \*Investigations, \*Data collections, Analytical techniques, Water temperature, Winds, Water levels, Lakes, On-site investigations, Model

Identifiers: \*Loch Ness (Scotland), Asymmetry.

Loch Ness, Scotland seems to be particularly suitable for internal wave research. Because it is freshwater the effects of salinity, which are so difficult to monitor in the ocean, are absent. The dominant internal seiche has a wave-length twice the length of the Loch, and a marked asymmetry. Observations of the temperature structure of the Loch, using thermistors at ten levels at a station in Urquhart Bay were made from September 7 to October 12, 1970, and these confirm the asymmetrical shape of the seiche determined earlier. The asymmetry of the internal seiche of Loch Ness seems to be the result of a tendency for internal surges as a result of non-linear long wave effects. It is likely that the effect of the Earth's rotation is principally to cause a small alternating transverse tilt of the isotherms across the Loch during the seiching motion. (Woodard-USGS)

#### CHANGES IN THE CHEMICAL COMPOSITION OF SEDIMENTS OF LAKE WASHINGTON, 1958-1970,

Minnesota Univ., Minneapolis. Limnological Research Center; and Washington Univ., Seattle. Dept. of Zoology.

For primary bibliographic entry see Field 05B.

W71-09281

#### NUMERICAL ESTIMATES OF ANCIENT WAVES, WATER DEPTH AND FETCH, Florida State Univ., Tallahassee. Dept. of Geology. For primary bibliographic entry see Field 02J.

W71-09288

## LAKE ERIE: COMMON EFFORT CAN SAVE

Bureau of Commercial Fisheries, Washington, D.C. For primary bibliographic entry see Field 05C W71-09387

#### 2I. Water in Plants

## DARIAN PHYTOSOCIOLOGICAL DICTIONA-RY, Battelle Memorial Inst., Columbus, Ohio.

J. A. Duke, and D. M. Porter.

Available from the National Technical Information
Service as BMI-171-37, \$3.00 in paper copy, \$0.95
in microfiche. Report BMI-171-37, June 1, 1970. 70 p. 44 ref.

Descriptors: \*Plant populations, \*Nuclear explosions, \*Canal construction, Canal design, Excavation, Panama canal, Rain forest, Systematics, Speciation, Ecology.

This compilation includes the following tables: diagrammatic portrayal of forest types of Darian, key to Darian forest types, zonal vegetation types along potential canal routes, attributes of some Darian localities. Phytosociological terms, which apply to Latin American vegetation types similar to those of Panama, are defined. The plants are described in appendixes. New species are included which were found during the canal survey. (See also W71-09006) (Bopp-ORNL) W71-09010

# PRECIPITATION, ITS CHEMICAL COMPOSITION AND EFFECT ON SOIL WATER IN A BEECH AND A SPRUCE FOREST IN SOUTH SWEDEN,

Lund Univ. (Sweden). Dept. of Plant Ecology For primary bibliographic entry see Field 02K. W71-09081

RADIOECOLOGY OF CESIUM-137 AND STRONTIUM-90 IN A FOREST, Institute of Public Health, Tokyo (Japan); Kiryu Coll. of Technology (Japan); and Japan Analytical Chemistry Research Inst., Tokyo.
For primary bibliographic entry see Field 05B. W71-09241

#### 2J. Erosion and Sedimentation

#### TRANSPORT OF SHOAL DEPOSITS, Illinois Inst. of Tech., Chicago.

For primary bibliographic entry see Field 05G. W71-08947

#### SEDIMENT, OUR GREATEST POLLUTANT, Agricultural Research Service, Oxford, Miss. Sedi-

mentation Lab. For primary bibliographic entry see Field 05B. W71-09055

ISOLATION AND IDENTIFICATION OF STEROLS FROM A PLEISTOCENE SEDIMENT, California Univ., Berkeley. Dept. of Chemistry For primary bibliographic entry see Field 02H.

# PREDICTION OF IN-SITU ACOUSTIC AND ELASTIC PROPERTIES OF MARINE SEDI-

MENTS, Naval Undersea Research and Development Center, San Diego, Calif. Edwin L. Hamilton.

Geophysics, Vol 36, No 2, p 266-284, Apr 1971. 19 p, 3 fig, 7 tab, 69 ref, append.

#### **Erosion and Sedimentation—Group 2J**

Descriptors: \*Bottom sediments, \*Accoustics, \*Mechanical properties, \*Elasticity (Mechanical), Porosity, Shear strength, Velocity, Seismic studies, Sampling, Surveys, Geophysics, Density. Identifiers: Acoustic properties (Sediments), Elastic properties (Sediments).

This is one of several interrelated reports concerning sound velocity, elasticity, and related properties of marine sediments from several major environments in the North Pacific and adjacent areas. This report is concerned with the correction of laboratory values to in-situ values, and the prediction of in-situ values in the absence of any sediment data. Although the samples and values are related to the North Pacific and adjacent areas, the methods and techniques of prediction are applicable to other areas and sediments. The keys to prediction of in-situ properties of marine sediments are knowledge of (1) general physiographic provinces and their associated sediments, (2) sedimentary processes within these environments, (3) laboratory or in-situ values of properties of the principal sediment types within the environments, and (4) methods of correcting laboratory values to in-situ values. Using measured values of density and compressionalwave velocity (corrected to in-situ values), plus a computed value of the bulk modulus, the other elastic constants can be computed; these include compressibility, rigidity (shear) modulus, Poisson's ratio, and velocity of shear waves. Numerical examples are given of all computations. (Knapp-USGS) W71-09096

VARITATIONS IN DELTA S-34 IN SULFATES OF RECENT AND OLD SEA BASINS OF THE USSR (Russian: Variatsii del'ty S-34 v sul'fatakh sovremennykh i drevnikh morskikh vodovemov

Sovetskogo Soyuza), Vsesoyuznyi Neftyanoi Nauchno-Issledovatelskii Geologorazvedochnyi Institut, Leningrad (USSR). For primary bibliographic entry see Field 02K.

PRELIMINARY INVESTIGATION OF THE SURFICIAL SEDIMENTS IN THE CAP-BRETON CANYON (SOUTHWEST FRANCE) AND THE SURROUNDING CONTINENTAL

SHELF, Institut de Geologie du Bassin d'Aquitaine, Talence (France).

George P. Allen, Patrice Castaing, and Andre Klingebiel.

Marine Geology, Vol 10, No 5, p M27-M32, May 1971. 6 p, 2 fig, 1 tab, 15 ref.

Descriptors: \*Bottom sediments, \*Glacial drift, \*Sampling, \*Continental shelf, \*Sedimentation, Radioactive dating, Suspended load, Bed load, Silts, Clays, Sands, Sediment transport, Sedimentary structures, Pleistocene epoch.

Identifiers: \*Submarine canyons, \*France, \*Sedi-

mentary facies.

A total of 120 grab samples of the surficial sediments in the Cap-Breton, France, submarine canyon and surrounding continental shelf were collected and analyzed by grain-size sieving. A Q-mode Factor Analysis was made on the grain-size data in order to define the most meaningful facies types. Four distinct lithological facies were found to exist: silt and clay, very fine sand, fine sand, and coarse sand. Comparison with previous work and a C-14 date on the silt and clay facies showed that the facies are not contemporaneous. The sands and coarse sands on the shelf were emplaced during the pre-Wurm and Wurm regressions, and later probably reworked during the Holocene (Flandrian) transgression. The silty clays found in the canyon and on the shelf to the south are younger and represent sediments brought in as suspended load by the Adour and other nearby rivers during the Holocene (Flandrian) transgression. (Knapp-USGS) W71-09100

HOLOCENE SEDIMENTATION IN THE STRAIT OF OTRANTO BETWEEN THE ADRIATIC AND IONIAN SEAS (MEDITER-RANEAN),

Technische Hochschule, Munich (West Germany). Institut fuer Geologie; and Technische Hochschule, Munich (West Germany). Dept. of Marine Geolo-

Munich (West Germany), Dept. of Managery gy and Sedimentalogy. R. Hesse, U. Von Rad, and F. H. Fabricus. Marine Geology, Vol 10, No 5, p 293-355, May 1971. 63 p, 23 fig, 78 ref, 3 append.

Descriptors: \*Bottom sediments, \*Sedimentary structures, \*Stratigraphy, Continental shelf, Continental slope, Benthos, Geomorphology, Provenance, Sedimentation, Particle size, Geomorphology, Provenance, Sedimentation, Particle size, Mineralogy, Turbidity currents, Sediment trans-

Identifiers: \*Mediterranean, \*Adriatic Sea, \*Ionian

An extensive radiograph study of 24 undisturbed, up to 206-cm long, box and gravity cores from the western part of the Strait of Otranto revealed a great variety of primary bedding structures and secondary burrowing features. The regional distribution of the sediments according to their structural, textural, and compositional properties reflects the major morphologic subdivisions of the strait into shelf, slope, and trough bottom. The terrigenous components of the surface sediments as well as those of the deeper sand layers can be derived from the Apulian shelf and the Italian mainland (Cretaceous Apulian Plateau and Gargano Mountains, southern Appenines, volcanic province of the Monte Vulture). Indicated by the heavy mineral glaucophane, a minor proportion of the sedimentary material is probably of Alpine origin. If this portion is considered to be first-cycle clastic material it recahes the Strait of Otranto after a longitudinal transport of 700 km via the Adriatic Sea. The lack of phyllosilicates in the coarse- to medium-grained shelf samples might be explained by the activity of the 'Apulian Current' (surface velocities up to 4 knots) which in the past possibly has affected the bottom almost down to depths of the shelf edge. The percentage of planktonic organisms, and also the plankton; benthos ratio in the sediments is a useful indicator for bathymetry (depth zonation). (Knapp-USGS) W71-09101

**CROSS-BEDDED TIDAL MEGARIPPLES FROM** SOUND (NORTHWESTERN

TRALIA),
Bureau of Mineral Resources, Geology and
Geophysics, Canberra (Australia).
For primary bibliographic entry see Field 08B.
W71-09122

SKEWNESS AS AN ENVIRONMENTAL INDICATOR IN THE SOLANI RIVER SYSTEM, ROORKEE (INDIA),

Oil and Natural Gas Commission, Ahmedabad (In-

dia). A. K. Awasthi.

Sedimentary Geology, Vol 4, No 2, p 177-183, June 1970. 7 p, 2 fig, 1 tab, 10 ref.

Descriptors: \*Particle size, \*Alluvial channels, \*Sediment transport, \*Deposition (Sediments), \*Sedimentation, \*Statistical methods, Statistics, Frequency analysis, Distribution patterns, Bed load, Suspended load, Channel morphology, Mean-

Identifiers: \*India.

All of the grain-size parameters of terrigenous sediments, the sign of skewness is the most sensitive to environmental conditions of deposition. The sediments, skewed negatively at the river confluences and the upstream parts of meanders are indicative of turbulent energy conditions in the depositing medium. The positively skewed sediments at the downstream parts of meanders and the straighter parts of the river system, point to a calm and steady energy environment of sedimentation. However, the skewness value is not correlatable with the

changes in the energy of the depositing medium. It is only the sign of skewness that indicates the state and the nature of the energy of the depositional agent. (Knapp-USGS) W71-09123

# SIGNIFICANCE OF PEBBLE SIZE AND SHAPE

IN SORTING BY WAVES, Nature Conservancy, Wareham (England). Furzebrook Research Station.

A. P. Carr, R. Gleason, and A. King. Sedimentary Geology, Vol 4, No 2, p 89-101, June 1970. 13 p, 4 fig, 3 tab, 16 ref.

Descriptors: \*Beaches, \*Particle size, \*Particle shape, \*Waves (Water), \*Sediment transport, Regression analysis, Sampling, Statistical methods, Erosion, Surf, Density, Bed load, Deposition (Sediments)

Identifiers: Sorting (Sediments), Grading (Sediments).

Means, standard deviations and standard errors are compared for length, breadth, thickness and weight of samples 500 quartzite and flint/chert pebbles from six beach crest sites on the shingle beach at Chesil Beach, Dorset, England. Because of the conditions prevailing, grading alongshore is especially well developed. The data are used in examining various shape ratios and indexes including LUT-TIG's sigma and pi, the WENTWORTH-CAIL-LEUX flatness index, KRUMBEIN's sphericity indexes and the maximum projection index and the maximum projection indexes. dex, and the maximum projection index of SNEED and FOLK. The only comparable dimension or index between the quartzite and flint/chert population is thickness. Since the specific gravity of both lithological types is the same it would appear that over the range of pebble sizes and shapes on this beach, thickness is the critical dimension in determining the overall sorting of pebbles by wave action. (Knapp-USGS) W71-09124

# DISTRIBUTION AND THICKNESS OF QUATERNARY SEDIMENTS IN THE LAKE

CONSTANCE BASIN, Heidelberg Univ. (West Germany). Sediment Research Lab.; and Dalhousie Univ., Halifax (Nova Scotia). Dept. of Geology. German Muller, and Rudolf A. Gees.

Sedimentary Geology, Vol 4, No 1, p 81-87, Mar 1970. 7 p, 5 fig, 5 ref.

Descriptors: \*Sedimentation, \*Seismic studies, \*Bottom sediments, \*Lakes, \*Distribution patterns, Glaciers, Geomorphology, Lake morphology, Lake basins, Lake beds, Topography, Surveys. Identifiers: \*Lake Constance (Germany).

Distribution and thickness of Pleistocene and Holocene sediments are derived from a continuous seismic reflection survey of the Lake Constance Basin. The sediment distribution within the lake confirms the concept that the Lake Constance Basin has been formed by glacial erosion rather than by structural deformation. (Knapp-USGS) W71-09125

#### COASTAL REGIME - RECENT U. S. EX-PERIENCE,

Corps of Engineers, Washington, D.C. Coastal Engineering Research Center.
For primary bibliographic entry see Field 08B. W71-09141

#### RIVER BED DEGRADATION,

Asian Inst. of Tech., Bangkok (Thailand). For primary bibliographic entry see Field 08B. W71-09149

DUNES LONGITUDINAL OF NORTHWESTERN EDGE OF THE SIMPSON DESERT, NORTHERN TERRITORY, AUS-

## Group 2J - Erosion and Sedimentation

TRALIA, 1. GEOMORPHOLOGY AND GRAIN SIZE RELATIONSHIPS, Texas Univ., Austin, Dept. of Geological Sciences. Robert L. Folk. Sedimentology, Vol 16, No 1-2, p 5-54, Mar 1971. 50 p, 16 fig, 1 tab, 183 ref.

Descriptors: \*Dunes, \*Deserts, \*Sediment transport, \*Aeolian soils, \*Particle size, Sedimentary structures, Wind erosion, Statistical methods. Identifiers: \*Sorting (Sediments), \*Simpson Desert (Australia).

Origin of the longitudinal dune form is reviewed. The spectacular longitudinal dunes of the Simpson desert are caused by helicoidal wind flow of the prevailing south-southeastern winds, acting upon ancient alluvial plains. Critical in this theory is the evidence from 'tuning-fork' dune junctures, which open upwind as do similar features in other geologic realms of primarily one-directional currents undergoing second-order helicoidal circulation. Review of previous work on using grain size to distinguish beach from dune sands reveals the consistent good sorting and positive skewness of coastal dunes. Simpson desert dunes are also posi-tively-skewed, but are not as well sorted as coastal dunes because they are only recently derived from poorly-sorted alluvial source sediments. Dune poorly-sorted alluvial source sediments. Dune crests are coarsest and best sorted because they are made out of the most easily saltated fine sand (about 2.5 ph); windward flanks, leeward flanks, and reg are progressively finer and also show regular and explainable changes in the higher-order grain-size parameters. Both dune and reg sediments are polymodal mixtures, giving rise to a 'quantum theory' of aeolian deposition. (Knapp-USGS) W71-09279

TURBIDITIES OF THE NORTHEAST PACIFIC, Lamony-Doherty Palisades, N.Y. Observatory, Geological

D. R. Horn, M. Ewing, M. N. Delach, and B. M. Horn.

Sedimentology, Vol 16, No 1-2, p 55-69, Mar 1971. 15 p, 5 fig, 1 tab, 40 ref. Naval Ship Systems Command Contract N00024-67-C-1184; ONR Contract N00014-67-A-0108-0004; NSF Grant NSF-GA-1193.

Descriptors: \*Bottom sediments, \*Turbidity currents, \*Sediment transport, \*Pacific Ocean, Sands, Continental slope, Density currents, Suspended load, Bed load, Particle size, Sedimentary structures, Deposition (Sediments), Silts, Clays. Identifiers: Grading (Sediments).

The northeast corner of the Pacific Ocean is a region of turbidity-current activity. Cores from this area are dominated by very fine-grained sand and medium-grained silt that grade upward to clay. This paper is based on 217 textural analyses of turbidite layers comprising 30 piston cores. It is possible to distinguish associated disclosured for the state of the state distinguish proximal and distal facies of turbidites using characteristics of layering, grading and tex-ture. Features of the proximal facies include wide range of layer thickness, maximum layer thickness, non-grading, truncation of grading, textural reversals, and sand at the base of graded layers. Areas beyond main routes of submarine flows are sites of episodic addition of silt-through clay-sized sediment. The proportion, thickness, and mean grain size of the silt decreases with increasing distance from the main avenues of flow. (Knapp-USGS) W71-09280

A COARSE-GRAINED POCKET BEACH COM-PLEX, TANAFJORD (NORWAY),

Oxford Univ. (England). Dept. of Geology and

Mineralogy.
D. K. Hobday, and N. L. Banks.
Scdimentology, Vol 16, No 1-2, p 129-134, March 1971. 5 p, 5 fig, 2 ref.

Descriptors: \*Beaches, \*Particle size, \*Particle shape, \*Gravels, \*Sediment transport, Surf, Sedimentation, Shores, Sedimentary structures.
Identifiers: \*Pocket beaches, \*Norway, Sorting.

The bulk of the material of the pocket beach at the mouth of the Manndraperely, Tanafjord, northern Norway, is supplied by the river. The stream bed consists of poorly sorted coarse sediments which show a crude upstream imbrication. Dampening of wave activity near the mouth of the stream by the wave activity near the mouth of the stream by the outflow of water caused relatively fine-grained material to accumulate on spits. Size-shape sorting by waves concentrates the finest pebbles on landward moving swash bars. Away from the stream mouth beach deposits become finer grained landward, and are zoned in a manner that might be confirmed with consequently spits. ward, and are zoned in a manner that might be con-fused with coarse-grained fluviatile sequences. Study of the textures of the Manndraperely deposits establishes criteria for distinguishing between these two possibilities. (Knapp-USGS) W71-09282

BREAK OF SLOPE IN PARTICLE-SIZE CURVES OF GLACIAL TILLS,

Durhan Univ. (England). Dept. of Geography.

Peter Beaumont.
Sedimentology, Vol 16, No 1-2, p 125-128, March 1971. 4 p, 1 fig, 1 tab, 1 ref.

Descriptors: \*Particle size, \*Glacial drift, \*Till, \*Sieve analysis, \*Sands, Gravels, Frequency analysis, Statistical methods, Distribution patterns,

Provenance. Identifiers: \*Particle size analysis, \*England.

In studies of particle-size distribution of the less than 20-mm fraction of glacial clays in eastern Dur-ham, England, one particular characteristic seems common to them all; when the particle-size data common to them all; when the particle-size data obtained by sieving and hydrometer analysis are plotted on semi-logarithmic graph paper almost all the curves are made up of two shallow concave or straight sections separated by a small section of varying convexity. This convexity or marked break of slope is nearly always found in the range 0.2-0.8 mm. The break of slope shows that the material in the finer grain sizes is more abundant than the coarser material, and that there is a change in the nature of the sediment from a dominance of rock nature of the sediment from a dominance of rock fragments to one of mineral grains. Therefore, the break of slope is obviously related to local parent material, and probably reflects the wearing effect of the ice on the rock framents included within it. In different areas it would seem likely that this break of slope in the particle-size curve of glacial tills would take place at different grain sizes and be a reflection of the dominant particle-size distribution of the parent material over which the ice was moving. In this case Carboniferous sandstones are considered to be the main parent material of the till shcet. (Knapp-USGS) W71-09283

EFFECT OF CLAY ON THE ACCURACY OF THE HYDROMETER METHOD, Indian Inst. of Tech., Kanpur. Dept. of Civil En-

For primary bibliographic entry see Field 07B. W71-09284

CORRELATION OF SEDIMENT CORES ON THE BASIS OF THEIR MAGNETIZATION.

Bundesanstalt fuer Bodenforschung, Hanover (West Germany). Dietrich Heye.

Sedimentology, Vol 16, No 1-2, p 111-117, March 1971. 7 p, 6 fig, 5 ref.

Descriptors: \*Bottom sediments, \*Magnetic studies, \*Cores, Sampling, Atlantic Ocean, Sedimentology, Sedimentation, Stratigraphy, Indian Ocean. Identifiers: Magnetization (Sediments).

Sediment cores originating from the Indian and the Atlantic Ocean were investigated. The declination of the cores was measured non-destructively. In both regions it was possible to correlate several cores on the basis of their magnetization (intensity correlation in contrast to correlation of paleomagnitic supports). Additional language of the bidding of the correlation of the contrast to correlation of the contrast to correlation of the co netic reversals). Additional layers of turbidity-currents and a layer of volcanic material were detected. (Knapp-USGS)

W71-09285

SLUMPING ON A CONTINENTAL SLOPE INCLINED AT 1-4 DEGREES,

INCLINED AT 1-4 DEGREES, New Zealand Oceanographic Inst., Wellington. Dept. of Scientific and Industrial Research; and Victoria Univ., Wellington (New Zealand). Dept. of Geology. K. B. Lewis

Sedimentology, Vol 16, No 1-2, p 97-110, March 1971. 4 p, 4 fig, 1 tab, 35 ref.

Descriptors: \*Landslides, \*Continental slope, \*Sedimentation, Turbidity currents, Mud, Sedimentary structures, Bottom sediments. Identifiers: \*Slumping.

Continuous seismic profiles from the upper continental slope east of North Island, New Zealand, show that surface sediment 10-50 m thick has slumped down bedding planes sloping at 1-4 deg. There are four slumps, the Kidnappers Slump which has an area of 250 sq km, the Paoanui Slump of 80 sq km, a small slump of only several square kilometers and a slump of undetermined extent. All occurred during the last 20.000 years in Last Glacurred during the last 20,000 years in Last Glacial Age sediments. A glide plane is exposed at the head of each slump and beds are thrust or contorted at the toe of some slumps. Slumping was probably caused by the failure of loosely packed sandy silt during major earthquakes. (Knapp-USGS) W71-09286

MICRITIC ENVELOPES OF CARBONATE GRAINS ARE NOT EXCLUSIVELY OF PHOTOSYNTHETIC ALGAL ORIGIN, Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences; and Barnard College, New York. Dept. of Geology. Gerald M. Friedman, Conrad D. Gebelein, and John F. Sanders

John E. Sanders. Sedimentology, Vol 16, No 1-2, p 89-96, March 1971. 7 p, 27 ref.

Descriptors: \*Carbonate rocks, \*Sedimentary Descriptors: \*Carbonate rocks, \*Sedimentary structures, \*Algae, \*Paleohydrology, \*Sedimentation, Sedimentology, Stratigraphy, Limestones, Marl, Chemical precipitation, Deposition (Sediments), Biochemistry. Identifiers: \*Micrite.

Micritic envelopes are commonly believed to develop from the lime-mud infillings of circum-ferential perforations made in skeletal particles by ferential perforations made in skeletal particles by algae. Because 'algae' are usually taken to mean photosynthetic algae, it has been proposed that micritic envelopes would not appear on carbonate skeletal particles originating in waters too deep for active growth of photosynthetic algae. This depth-limiting concept of the origin of micritic envelopes is challenged for two reasons: (1) petrographic study of a large number of thin sections thought to be representative of various paleo-denth levels be representative of various paleo-depth levels does not indicate any systematic variations in the preservation of the outlines of skeletal particles; and (2) molluscan skeletal debris displaying micritic envelopes and effects of borings identical with those generally ascribed to the activities of photosynthetic algae were found in an aragonite-cemented sandstone from the Atlantic shelf where geologic evidence indicates that the water at time of boring was too deep for active growth of photosynthetic algae. Organisms other than photosynthetic algae can bore into calcareous materials. In particular, fungi, bacteria, and heterotrophic algae (whose distribution does not depend on the penetration of light into seawater) are known to be active borers. (Knapp-USGS) W71-09287

NUMERICAL ESTIMATES OF ANCIENT WAVES, WATER DEPTH AND FETCH, Florida State Univ., Tallahassee. Dept. of Geology. ANCIENT William F. Tanner.

Sedimentology, Vol 16, No 1-2, p 71-88, March 1971. 8 p, 1 fig, 4 tab, 11 ref.

#### Erosion and Sedimentation—Group 2J

Descriptors: \*Sedimentary structures, \*Ripple marks, \*Particle size, \*Waves (Water), \*Regression analysis, Currents (Water), Paleohydrology, Oceanography, Lakes. Identifiers: \*Sorting (Sediments).

A series of carefully controlled marine experiments, in which sand of known grain diameter and essentially perfect sorting was exposed to waves of various sizes, was supplemented by study of lakes of various widths (and hence differing values for fetch), in an effort to obtain relationships between parameters measurable in sedimentary rocks (i.e., ripple-mark spacing) and paleogeographic infor-mation (water depth, wave height, wave length, and fetch). Regression equations were obtained, relating ripple-mark spacing to grain size, water wave-length, water depth, and water wave-height. In general those based on water wave-length were erior to those based on water wave-height. In shallow water, the values which can be obtained from these equations are highly limited in range, and thus define the palegeographic unknowns reasonably closely. These values can be inserted into three additional equations, which relate fetch to various wave parameters. (Knapp-USGS)

# GEOLOGICAL OBSERVATIONS OF THE MIAMI TERRACE FROM THE SUBMERSIBLE BEN FRANKLIN,

BEN FRANKLIN,
Woods Hole Oceanographic Institution, Mass.
Robert D. Ballard, and Elazar Uchupi.
Marine Technology Society Journal, Vol 5, No 2, p
43-48, March-April 1971. 6 p, 4 fig, 1 tab, 10 ref.
ONR Contract 3484; USGS Contract 12109.

\*Continental \*Submarines, Oceanography, Bathymetry, Sounding, Seismic studies, Profiles, Florida, Underwater, Topography, Sedimentary Florida, Underwater, Topography, Sedimentary structures, Geomorphology, Stratigraphy, Currents (Water), Mineralogy, Atlantic Ocean. Identifiers: Miami terrace (Fla).

Observations made from the submersible Ben Franklin were used to complement earlier investigations of the Miami Terrace. The terrace is divided into four geomorphic provinces: a Pliocene-Quarternary wedge of prograding sediments, a central irregular platform covered by a continuous pavement of phosphorite, an outer terrace ridge province also covered with phosphorite, and an outer terrace slope composed of sediments and large phosphorite covered talus blocks. Visual observations, bottom samples, and current measurements made in each of these four provinces by the submersible were compared with previously obtained results based upon the conventional techniques of seismic profiling, echo-sounding, and bottom photography. (Knapp-USGS)
W71-09290

## MEASUREMENTS OF THE ENGINEERING PROPERTIES OF MARINE SEDIMENTS, Naval Academy, Annapolis, Md. Dept. of Ocean

Engineering.

N. T. Monney.

Marine Technology Society Journal, Vol 5, No 2, p 21-30, March-April 1971. 10 p, 41 ref.

Descriptors: \*Bottom sediments, \*Shear strength, \*Instrumentation, \*Mechanical properties, \*Onsite testing, Coastal engineering, Civil engineering, Engineering geology, Foundation investigations. Identifiers: Marine sediments.

Instruments currently used to measure engineering properties of marine sediments in situ are evaluated with respect to actual performance and required accuracies. The inherent difficulties of measuring these properties in the laboratory rather than in situ are reviewed, and test results are provided which indicate existing sampling devices and procedures produce questionable results. Measurement of shear strength of sediments is of particular interest to engineers, and development of an in situ direct shear device is recommended. A bore-hole directshear device which measures the internal angle of friction and cohesion from inside bored holes is under development. The device is a split cylinder with horizontal knife edges which is hydraulically loaded within a bore hole in a radial direction. When the sediment is consolidated under an increment of load the cylinder is pulled until shear failure occurs. Additional loads and pulls provide a measure of shear strength under increasing normal stress. Tests on sand, loam, silt and clay demonstrate close agreement between in situ tests and laboratory triaxial and direct shear tests. With modifications it should be feasible to utilize the device for measuring the shear strength of marine sediments. (Knapp-USGS) W71-09291

# INTERAGENCY APPROACH TO WATERSHED PROBLEMS OF EEL RIVER, California State Dept. of Water Resources, Red

Bluff. Northern District.

Eugene F. Serr.

Proceedings of the American Society of Civil Engincers, Journal of the Irrigation and Drainage Division, Vol 97, No IR-1, Paper 7983, p 181-192, March 1971. 12 p, 2 fig, 2 tab, 8 ref.

Descriptors: \*Sediment yield, \*California, \*Erosion, \*Suspended load, Provenance, Landslides, Stream erosion, Gully erosion, Sediment control, Erosion control, Water quality control. Identifiers: \*Eel River (Calif).

Watershed studies in the Eel River basin, California, are summarized. The U. S. Geological Survey estimated the long-term average suspended sediment load near the mouth at 7,400 tons per sq mile of drainage area. Among larger rivers of the world, this figure is known to be exceeded only by the Yellow River of China and certain of its tributaries, and the Semani River in Albania. The U. S. Soil Conservation Service found that the principal sediment sources in the basin were streambank erosion (54%), landslides (26%), and sheet and gully erosion (10%). The maximum feasible sediment reduction through land treatment measures was estimated at about 20%. Active and intensive watershed management can be expected in the future in problem areas in the Ecl River basin as measures such as cover manipulation become economically feasible and more is learned about wildland water quality and quantity control. (Knapp-USGS) W71-09292

# NET KINETIC ENERGY IN LITTORAL TRANS-

Florida State Univ., Tallahassee. Dcpt. of Geology. William F. Tanner.

Science, Vol 172, No 3989, p 1231-1232, June 18, 1971. 2 p, 5 ref.

Descriptors: \*Kinetics, \*Sediment transport, \*Littoral drift, \*Beach erosion, Coastal engineering, Shore protection, Soil management, Gulf of Mexico, Florida.

Identifiers: \*Net Kinetic energy, \*Littoral transport, Coastal management.

Studies of coastal erosion and coastal management are discussed. Studies can be put on a firm physical basis after methods are developed for closely estimating the energy expended in actual unidirectional net littoral transport of sediment. Such measures have been obtained for six coastal drift cells. The results, for a 68-year period, vary from a minimum of 0.6 X 10 to the 4th power ergs (very low energy) to a maximum of 340 X 10 to the 4th power ergs (moderately high energy) per cell. Data are analyzed for the Gulf of Mexico southwest of Tallahassee, Florida, and include the mass volume of sand moved, the distance moved, and the time interval covered. (Lang-USGS) W71-09298

THE SEDIMENT ON THE FLOOR OF THE SOUTHERN IRISH SEA, University Coll. of Wales, Aberystwyth. Dept. of

Geology.'
M. R. Dobson, W. E. Evans, and K. H. James.
Marine Geology, Vol 11, No 1, p 27-69, June 1971.
43 p, 10 fig, 74 ref, append.

Descriptors: \*Bottom sediments, \*Tidal effects, \*Sediment transport, \*Sand waves, \*Currents (Water), Sampling, Data collections, Deposition (Sediments), Sedimentary structures, Ripple marks, Sands, Carbonates, Particle size, Provenance, Tides, Water circulation. Identifiers: \*Irish Sea.

The southern Irish Sea was surveyed using Asdic, continuous reflexion profiling, echo sounding, and bottom samples. The results are presented in the form of a sediment facies chart. Some of the major sea-bed features were interpreted using seismic data. Bed forms, principally sand waves, sand rib-bons and sand streams, were identified and their hierarchical associations established; these have provided insight into the patterns of sediment cir-culation. The form of these patterns is directly under the control of the tidal regime (which, in the southern Irish Sea, is the reverse of that normally found around British coasts). Along the Irish coast the tidal form consists of high velocities associated with negligible range: on the Welsh side low velocities and a pronounced range are the usual association. The effects of these tidal peculiarities on the sediment are to create a bedload separation on the Irish shelf, and a coalescence on the Welsh side. The sub-littoral sands are essentially quartzose with a strongrock debris component, carbonate contents being generally low (5%). Offshore and in mid-channel, there is a variable carbonate component which is bidmodal as a result of whole shell imposition. Macrofauna communities, broadly defined in association with bottom characteristics, illustrate relationships between source material and detrital organogenic sediment. (Knapp-USGS) W71-09305

# DIFFERENTIAL EROSION OF CARBONATE-

ROCK TERRANES, Geological Survey, Raleigh, N.C.; and Geological Survey, Washington, D.C.
H. E. Le Grand, and V. T. Stringfield.
Southeastern Geology, Vol 13, No 1, p 1-17, May 1971. 17 p, 3 fig, 28 ref.

Descriptors: \*Geomorphology, \*Erosion, \*Carbonate rocks, \*Karst, \*Limestones, Weathering, Leaching, Topography, Water chemistry, Residual soils, Soil water, Soil formation, Vegetable effects,

Groundwater.
Identifiers: \*Karst topography, \*Carbonate-rock topography.

Relief in carbonate-rock terranes may be local and small as expressed by many shallow sinkholes, or large as expressed by polics and escarpments. In addition to relief within the karst terrane, there is commonly significant relief between a belt of carbonate rocks and an adjacent belt of noncarbonate rocks. Erosion in carbonate terranes is favorable under moderate rather than under extreme conditions of cover, purity of the carbonate rock, topographic relief, and precipitation. Denuded carbonate rocks are much more resistant to physical and chemical erosion than are carbonate rocks with a mderately thin soil and vegetal cover; where the soil and rock cover is very thick, physical ero-sion of the covered bed is impossible and chemical erosion may be retarded because of retarded water circulation. Pure carbonate rocks yield no insoluble residue to form a cover; also, intense precipitation tends to strip off a thin cover and to keep the rock denuded. If the carbonate rocks are relatively impermeable, water cannot easily penetrate rock to aid soil development. Thus, the degree of cover on a carbonate terrane is an important key to differential erosion and to much of the topographic relief. (Knapp-USGS) W71-09307

# **Group 2J—Erosion and Sedimentation**

# LITHOLOGY OF ROCKS DREDGED FROM

THE BLAKE PLATEAU, Virginia Polytechnic Inst., Blacksburg. Dept. of Geological Sciences.

Richard M. Pratt. Southeastern Geology, Vol 13, No 1, p 19-38, May 1971. 20 p, 6 fig, 44 ref.

Descriptors: \*Bottom sediments, \*Continental slope, \*Sampling, Surveys, Carbonates, slope, \*Sampling, Surveys, Caroonaus, Phosphates, Manganese, Chemical precipitation, Deposition (Sediments), Sedimentation, Sediment Transport, Florida, Atlantic Ocean, Currents (Water), Water circulation.
Identifiers: \*Gulf Stream, \*Blake Plateau.

Dredge samples and photographs from the Blake Plateau, off the southeastern coast of the United States, were used to study the bottom material, which has both a sediment component and a rock component. Sediment is characteristically very well sorted foraminiferal sand except near the Bahama Banks where it is carbonate lutite. The rock fraction can conveniently be separated into limestone, coral, phosphate concretions and manganese concretions. Coral is most abundant beneath the axis of the Gulf Stream and owes its growth to a long-term equilibrium condition between sedimentation and erosion maintained by the currents. The coral helps to stabilize the bottom by trapping fine sediment. Phosphate nodules occur extensively from the slope to the other escarptment across the northern end of the Plateau, and in a small area off Miami, Florida. Manganese concretions are forming under present day conditions. The manganese concretions grow by replacement of phosphate nodules as well as by simple accretion. Their overall chemical composition is similar to that of deep-sea deposits. The Gulf Stream is the controlling environmental factor in the area and the distribution of all rocks and most fine sediment can be related to the current regime. (Knapp-USGS) W71-09308

# THE OFFSET COURSE OF THE ST. JOHNS RIVER, FLORIDA, North Carolina Univ., Chapel Hill.

William A. Pirkle.

Southeastern Geology, Vol 13, No 1, p 39-59, May 1971. 21 p, 8 fig, 3 tab, 25 ref.

Descriptors: \*Geomorphology, \*Rivers, \*Valleys, \*Florida, \*Karst, Limestones, Aquifers, Channels, Surface-groundwater relationships, Erosion, Discharge (Water), Topography, Springs. Identifiers: \*St. Johns River (Fla).

The northward-flowing St. Johns River is the dominant river in eastern peninsular Florida. At a point east of Sanford, Florida, the river turns toward the west to reach an older valley that it follows northward almost to Palatka before turning to the east to flow again over a younger terrain. The offset valley probably marks part of the course of an ancestral river. Factors believed to be important in the development of the valley include faulting and fracturing, solution of carbonate sediments, and favorable structures for artesian discharge. The preservation of the offset valley as a major stream course is due primarily to the discharge of large quantities of artesian water. Much of this discharge is made possible in the northern part of the offset area by the relatively permeable nature of the aquiclude and in the central and southern areas of the offset by the exposure of the aquifer. The numerous springs from Lake George southward mark sites where the aquifer is exposed or breached. (Knapp-USGS) W71-09309

#### EXPERIMENTS ON THE ANGLES OF REPOSE OF GRANULAR MATERIALS,

Research Council of Alberta, Edmonton. Maurice A. Carrigy.
Sedimentology, Vol 14, No 3/4, p 147-158, July 1970. 12 p, 5 fig, 5 tab, 4 ref. Descriptors: \*Slope stability, \*Avalanches, \*Sedimentary structures, Topography, Soil stability, Landslides, Sedimentation, Stratification, Dunes. Identifiers: \*Angle of repose (Sediments).

A simple apparatus for measuring the angles of repose of masses of granular material in various media is based on the rotating-drum principle. Two angles of repose are measured by this method. The critical angle of repose is defined as the angle through which a mass of granular material can be rotated before it fails by avalanching, and the angle of rest is defined as the inclination of the slope after avalanching has ceased. For materials with similar surface characteristics the angles of repose increase with departure of the grains from a spherical form. For masses of spherical particles the angles of repose increase with increasing intergranular friction caused by differences in surface characteristics. For mixtures of spheres and cubes the angles of the angles of the spheres and cubes the angles of the ang gles of repose are proportional to the volumes of the end members present. For natural quartz sands the citical angle of repose is always greater in air than under water, but the angle of rest is the same in both media. (Knapp-USGS) W71-09314

## THE TIDE-SWEPT CONTINENTAL SHELF SEDIMENTS BETWEEN THE SHETLAND ISLES AND FRANCE,

National Inst. of Oceanography, Wormley (En-

gland). N. H. Kenyon, and A. H. Stride.

Sedimentology, Vol 14, No 3/4, p 159-173, July 1970. 15 p, 8 fig, 32 ref.

Descriptors: \*Bottom sediments, \*Sediment transport, \*Continental shelf, Tides, Tidal effects, Tidal waters, Currents (Water), Bed load, Ripple marks, Littoral drift, Surveys, Sounding, Acoustics. Sampling,

Identifiers: \*Tidal currents, \*Irish Sea, Bristol Channel.

Extensive data obtained by side-scan Asdic and echo-sounder equipments, viewed in conjunction with bottom notations on navigational charts and some sea-bed samples, show the widespread occurrence of sand ribbons, sand waves and sand patches on the continental shelf west of the British Isles and France. The close similarity of their directional trends with those of the strongest tidal currents strongly suggests a causal relationship which applies to much of the continental shelf, parts of the upper continental slope and also to off-lying shoals such as Rockall Bank. The sand transport paths broadly parallel the coasts in the epicontinental seas and on the open shelf west of the British Isles. In contrast, the paths are substantially normal to much of the coast of western France. (Knapp-USGS) W71-09315

# PHREATIC VERSUS VADOSE METEORIC DIAGENESIS OF LIMESTONES: EVIDENCE FROM A FOSSIL WATER TABLE,

Texas Univ., Austin. Dept. of Geological Sciences. Lynton S. Land.

Scdimentology, Vol 14, No 3/4, p 175-185, July 1970. II p, 6 fig, 2 tab, 14 ref. NSF Grant GA-901; ACS PRF 3395-A2.

Descriptors: \*Diagenesis, \*Limestones, \*Ground-water movement, \*Weathering, \*Acolian soils, Water table, Dunes, Infiltration, Calcium carbonate, Sands, Percolation, Soil water movement, Water chemistry, Sedimentation, Stratigraphy, Water levels, Water level fluctuations. Identifiers: \*Bermuda.

The Middle Pleistocene Belmont Formation of Bermuda consists in part of beach-dune biocalcarenites which underwent intense contemporaneous cementation and diagenesis. The beach deposits were contemporaneously cemented by fibrous isophacous cement to form beachrock, whereas previously deposited eolianites further inland underwent intense meteoric phreatic diagenesis, resulting in coarse-grained cementation and stabilization of most of the metastable components of the rock. Above the Belmont water table, vadose diagenesis was relatively ineffective in cementing and altering the biocalcarenites. Phreatic meteoric diagenesis is interpreted to be a very rapid process, relative to vadose meteoric diagenesis, and to result in a much coarser-grained sparite. (Knapp-USGS)

# LATE PLEISTOCENE DIAGENESIS AND

DOLOMITIZATION, NORTH JAMAICA,
Texas Univ., Austin. Dept. of Geological Sciences;
and California Inst. of Tech., Pasadena. Div. of Geological Sciences.

Lynton S. Land, and S. Epstein. Sedimentology, Vol 14, No 3/4, p 187-200, July 1970. 14 p, 6 fig, 3 tab, 32 ref.

Descriptors: \*Diagenesis, \*Limestones, \*Reefs, \*Carbonate rocks, \*Coral, Algae, Water chemistry, Sea water, Dolomite, Rain water, Solubility, Calcite, Mineralogy, Equilibrium, Magnesium, Pleistocene epoch. Identifiers: \*Jamaica.

Diagenesis, including dolomitization, of Late Pleistocene reefs of North Jamaica is due to reaction with meteoric water. Although the reactions Mg-calcite to calcite, Aragonite to calcite, and Mgcalcite to dolomite retain microarchitectural information, complete chemical redistribution takes place so that incongruently dissolved Mg-calcites, aragonite inversion mosaics (neomorphosed aragonite), and dolomitized red algae have similar isotopic compositions, resembling precipitated calcite cements. The minerals all appear to have stabilized in the meteoric water environment. The dolomite is not widely distributed, and is restricted to replacement of red algae. There has been no net addition of magnesium to the red algal clasts. (K-napp-USGS)
W71-09317

#### SELF-OPERATED PIPETTE FOR GRAIN-SIZE ANALYSIS: A PROTOTYPE,

Florence Univ. (Italy). Inst. of Geology. For primary bibliographic entry see Field 07B. W71-09318

#### EXPERIMENTAL STUDY OF THE SORPTION OF POTASSIUM BY MONTMORILLONITE,

Akademiya Nauk SSSR, Moscow. Geologicheskii

V. I. Muravyov, and B. A. Sakharov. Sedimentology, Vol 15, No 1/2, p 103-113, Oct 1970. 11 p, 3 fig, 1 tab, 12 ref.

Descriptors: \*Clay minerals, \*Montmorillonite, \*lon exchange, \*Diagenesis, \*Potassium, Water chemistry, Mineralogy, Clays, Silicates, Cation adsorption.

Identifiers: Rectorite.

Experimental studies on saturation of montmorillonite with potassium showed that sorption of potassium tends to produce a regular alternation of the interlayer regions. The sorption nature of the potassium fixation by montmorillonite appears to form the basis of the epigenetic formation of rectorite. Comparison of the series of probability curves indicates that as concentrations of K increase, it is abosorbed in two phases with an obvious tendency to fixation in interlayer regions in every second layer. The tendency to regular alternation of montmorillonite and mica-lake interlayer regions in rectorite-type minerals arises at early stages of the process and is manifested in an 'ordered' interlayer sorption of cations. The progressive development of this process in the sedimentary series logically concludes to the substitution of Al for Si, primarily in layers already prepared for this by a general concentration of a positive charge. (K-napp-USGS) W71-09319 FORMATION OF CARBONATE CEMENT IN CLASTIC ROCKS, Akademiya Nauk SSSR, Moscow. Geologicheskii

V.I. Muravyov. Sedimentology, Vol 15, No 1/2, p 139-145, Oct 1970. 7 p, 3 fig, 5 ref.

Descriptors: \*Diagenesis, \*Calcite, \*Carbonates, \*Sandstones, Crystallization, Temperature, Pressure, Water chemistry, Magnesium, Iron, Clays minerals, Colloids, Aqueous solutions. Identifiers: \*Carbonate cements, Clastic rocks.

The texture of carbonate cement in clastic rocks reflects the conditions of: (1) free pore crystallization; or (2) recrystallization under elevated temperatures and pressures. Fibrous carbonate cement may be formed as a result of preferential adsorp-tion of clay particles or colloids in the direction perpendicular to c. Cryptocrystalline carbonate cement is formed in sandstones if the ratio of carbonate to argillaceous matter is less than 5 (for montmorillonite) or less than 3-4 (for illite). The maximum amounts of isomorphic admixtures of Mg and Fe in calcite cement can be used for temperature reconstructions of the epigenetic environ-ment. In deep-buried rocks, which are almost closed systems, migration rates are lower than diffusion rates. Microenvironments of detrital grain corrosion may exist adjacent to those of precipitation of the same mineral. (Knapp-USGS) W71-09320

# THE ORIGIN AND SIGNIFICANCE OF SAND VOLCANOES IN THE BUDE FORMATION (CORNWALL), Oxford Univ. (England). Dept. of Geology and

Mineralogy.

R. V. Burne.

Sedimentology, Vol 15, No 3/4, p 211-228, Dcc 1970. 18 p, 12 fig, 2 tab, 13 ref.

Descriptors: \*Sand boils, \*Sediments, \*Deposition (Sediments), \*Quicksand, \*Compaction, Permeability, Pressure, Flow, Porous media, Subsidence. Identifiers: \*Sand volcanoes, \*Fluidized sands.

Sand volcanoes are found in three sedimentary associations in the Upper Carboniferous Budge Formation. In two of these associations they formed when the dewatering of fluidized sand beds was temprarily inhibited by the deposition of overlying units. In the third association the volcanoes formed during the normal post-depositional compaction of fluidized, muddy, poorly sorted units deposited from subaqueous mudflows. The tops of fluidized sand beds were characteristically sheared by a fairly powerful current immediately after being deposited, while the waters above the recently deposited mudflow units were commonly stagnant, allowing sand volcano formation. (Knapp-USGS) W71-09321

#### MINERAL STUDIES IN THE GRAVITATION-GRADIENT FIELD: 1. THE METHOD,

Akademiya Nauk SSSR, Moscow. Geologicheskii

M. Ya. Katz.

Sedimentology, Vol 15, No 1/2, p 147-159, Oct 1970. 13 p, 4 fig, 1 tab, 18 ref.

Descriptors: \*Density, \*Mineralogy, \*Instrumenta-tion, \*Bouyancy, \*Hydrometry, Specific gravity, Temperature, Separation techniques.

New equipment is described for investigating the density properties of minerals and rocks. A description is given of the principle and operation of a liquid density-gradient tube, of density standards and of a device for the precise determination and separation of minerals. The possibility of using the method described for geological and mineralogical studies is discussed. (See also W71-09323) (Knapp-USGS) W71-09322

MINERAL STUDIES IN THE GRAVITATION-GRADIENT FIELD: 2. CHANGES OF QUARTZ SAND DENSITY DUE TO NATURAL AND EXPERIMENTAL 'MATURATION', Akademiya Nauk SSSR, Moscow. Geologicheskii

M. Ya. Katz, M. M. Katz, and A. A. Rassakazov. Sedimentology, Vol 15, No 1/2, p 161-177, Oct 1970. 17 p, 7 fig, 4 tab, 9 ref.

Descriptors: \*Sedimentation, \*Abrasion, \*Quartz, \*Sands, \*Density, \*Weathering, Erosion, Scour, Instrumentation, Silica, Mineralogy, Crystallog-

Identifiers: Quartz sand.

Studies of natural quartz and laboratory experiments on mechanical and chemical destruction of quartz show that the statistical density characteristics of detrital quartz change during sedimentary processes. Grains with defective structure, gasliquid inclusions, inclusions of organic matter and other lighter minerals have lesser densities, whereas grains with inclusions of heavier minerals have larger densities than those of optically pure grains. The susceptibility to destruction is less for optically pure grains than for grains with lower or higher density. This is responsible for the increas-ing maturity of quartz sand during weathering and transport as indicated by the increasing percentage of optically pure grains. Mathematical modelling of the dynamics of this process was carried out. (See also W71-09322) (Knapp-USGS) W71-09323

#### 2K. Chemical Processes

# ANALYSIS OF WATER FOR MOLECULAR HYDROGEN CYANIDE,

North American Rockwell Corp., Athens, Ga. Rocketdyne Div.

For primary bibliographic entry see Field 05A. W71-08952

# CHEMICAL CHARACTERISTICS OF PRECIPITATION IN THE CHAMPLAIN VAL-

Vermont Univ., Burlington. Dept. of Zoology. E. B. Henson.

Available from the National Technical Information Service as PB-200 167, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, June 1971. 10 p, 5 tab, 1 ref. OWRR Project A-007-VT (1).

Descriptors: \*Precipitation (Atmospheric), Calcium, Sodium, Magnesium, Potassium, Chloride, Sulfate, Vermont, \*Ions, \*Champlain Valley.

More than 1000 precipitation water samples were collected from a number of stations in the Champlain Valley, and six ions were measured (Ca, Na, Mg, K, Cl, SO sub 4). As anticipated, considerable variation existed between rains, and between stations. Concentrations were generally higher in urban locations than in rural stations. The median concentration for all samples were: Ca, 1.25; Na, 0.28; Mg, 0.20 K, 0.19; Cl, 1.7; and SO sub 4, 1.9 mg/l. When concentrations were examined on a seasonal basis, higher concentrations were observed during the winter months with the exception of SO sub 4 which was lowest in the winter. The median monthly loads in kg/km sq were: Ca, 99; Na, 36, Mg, 15, K, 21; Cl. 134; and SO sub 4, 147 kg/km sq. Precipitation brings down about 450 kg/km sq/month. The concentrations of the six ions, when compared with a high elevation mountain pond, indicate more Cl in rainfall than in the pond water. W71-08973

## ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS - 1969,

Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W71-09080

PRECIPITATION, ITS CHEMICAL COMPOSITION AND EFFECT ON SOIL WATER IN A BEECH AND A SPRUCE FOREST IN SOUTH SWEDEN,

Lund Univ. (Sweden). Dept. of Plant Ecology.

Bengt Nihlgard. Oikos, Vol 21, No 2, p 208-217, 1970. 10 p, 7 fig, 4 tab, 27 ref.

Descriptors: \*Water chemistry, \*Rainfall, \*Forests, Leaching, Soil water, Infiltration, Throughfall, Stem flow, Interception, Nutrients, Aerosols, Sampling. Identifiers: \*Sweden.

The quantitative distribution and the chemical composition of the rainfall in a 100-year old beech composition of the rainfall in a 100-year old beech forest and a neighboring 55-year old planted spruce forest are reported. Average annual values of throughfall, stem flow and interception are estimated as 70%, 11%, and 19% for the beech forest and 58%, 3%, and 39% for the spruce forest of the incident rainfall in an open field. The soil of the spruce forest is about 19% drier than that of the beech forest, because of high interception and long transpiration period of the former forest. The foltranspiration period of the former forest. The following chemical features are discussed: pH, conductivity, amounts of Na, K, Ca, Mg, Mn, Cl, SO4-S, PO4-P and tot.-N. Extrapolated annual values of nutrients in the throughfall plus stem flow amount to 107 kg/ha and 215 kg/ha in the beech and the spruce forests respectively. A high percentage of the nutrients must derive from dry deposited aerosols, particularly for Na, Mg, Cl and Ca. The higher amounts of nutrients in the rainfall of the spruce forest probably derived from stronger leaching processes in the canopy. (Knapp-USGS) W71-09081

#### GEOLOGY AND GROUNDWATER RESOURCES OF TRAILL COUNTY: PART 3 GROUNDWATER RESOURCES, GROUNDWATER Geological Survey, Bismark, N. Dak

For primary bibliographic entry see Field 02F. W71-09090

VARITATIONS IN DELTA S-34 IN SULFATES OF RECENT AND OLD SEA BASINS OF THE USSR (Russian: Variatsii del'ty S-34 v sul'fatakh sovremennykh i drevnikh morskikh vodovemov

Sovetskogo Soyuza), Vscsoyuznyi Neftyanoi Nauchno-Issledovatelskii Geologorazvedochnyi Institut, Leningrad (USSR). N. A. Yeremenko, and R. G. Pankina.

Geokhimiya, No 1, p 81-91, Jan 1971. 11 p, 3 fig, 3 tab, 18 ref

Descriptors: \*Sulfur, \*Geochemistry, \*Sedimentary basins (Geological), \*Geologic time, \*Stable isotopes, Stratigraphy, Sea water, Radioactive dating, Oceans, Sulfates, Sediments, Rocks, Aning, Od

Identifiers: \*USSR, Russian Platform, Caspian Sea, Black Sea, Evaporites, Peneplanation, Isotopic composition.

Changes in the isotopic composition of the sulfur of evaporites in a cross section of a sedimentary stratum of the USSR have the same trend as in other regions of the globe and strengthen the supposition that the isotopic composition of sulfur in sulfates of the world's oceans changes in the course of geologic time. A change in the isotopic composition of the sulfur of occans is due to the interaction of three basic factors: (1) supply of sulfur enriched in S-34 from the depths of the earth; (2) microbiological fractionation of sulfur isotopes in oceans and on land (secondary sulfates); and (3) loss of sulfur enriched in S-32 during peneplanation of continents. The average isotopic composition of sulfur of the earth's crust as compared with sulfur of chondrites shows a 15-20% shift in the direction of S-34. A regular change in the isotopic composition of the sulfur of evaporites in a cross section of a sedimentary stratum may be used for determining the stratigraphic affiliation of sulfate-containing rocks. (Josefson-USGS)

### **Group 2K—Chemical Processes**

RESULTS OF A STUDY OF ORGANIC MATTER IN GROUNDWATERS OF KAMCHATKA (Russian: Rezul'taty izucheniya or-ganicheskikh veshchestv v podzemnykh vodakh Kamchatki),

Kamchaiki), All-Union Scientific Rescarch Inst. of Hydrogeolo-gy and Engineering Geology, Moscow (USSR). Ye. L. Bykova, G. A. Goleva, and Z. B. Dekusar. Geokhimiya, No 2, p 225-237, Feb 1971. 13 p, 4 fig, 5 tab, 12 ref.

Descriptors: \*Organic matter, \*Groundwater, \*Thermal water, \*Rocks, Geochemistry, Water chemistry, Water analysis, Hydrogeology, Adsorption, Infiltration, Chromatography, Solvents. Identifiers: \*USSR, \*Kamchatka, Mineralization.

A relationship was established between the organic matter composition of the groundwater of Kamchatka and the geochemical conditions of groundwater formation and composition of waterbearing rocks. The relationship between waterbearing rocks and the organic matter dissolved in groundwater is expressed by the leaching of organic matter from the rocks and by the adsorption of organic matter on the rocks. Experimental field studies show that it is possible to use data on the organic component of groundwater for determining groundwater genesis. A study of the composition of organic matter in widespread nitrogen thermal waters of Kamchatka confirms their infiltration origin. (Josefson-USGS) W71-09099

CARBON MONOXIDE IN RAINWATER, Naval Research Lab., Washington, D.C. For primary bibliographic entry see Field 02B.

SOLUTES IN PRESSURE MEMBRANE FILTRATES OF SEVERAL CLAY-WATER-ELECTROLYTE SYSTEMS,

North Carolina State Univ., Raleigh. Dept. of Soil Science.

For primary bibliographic entry see Field 02G. W71-09116

HEAT TRANSFER MEASUREMENT IN A GEOTHERMAL AREA.

National Research Center for Disaster Prevention. Tokyo (Japan).

For primary bibliographic entry see Field 02F. W71-09117

HEAT FLOW FROM NATURAL GEYSERS,

ESSA Research Labs., Boulder, Colo.; and Colorado Univ., Boulder. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02F.

W71-09118

GEOCHEMICAL DISTRIBUTION PATTERNS AND MIGRATION FORMS OF GOLD IN NATU-AND MIGRATION FORMS OF GOLD IN NATURAL
WATERS (RUSSIAN: GEOKHIMICHESKIYE ZAKONOMERNOSTI RASPROSTRANENIYA I FORMY MIGRATSII
ZOLOTA V PRIRODNYKH VODAKH), MIGRATSII

All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR). G. A. Goleva, V. A. Krivenkov, and Z. G. Gudz'. Geokhimiya, No 6, p 744-757, June 1970. 14 p, 5 fig, 6 tab, 15 ref.

\*Gold, Descriptors: \*Water \*Geochemistry, Thermal water, Connate water, Mineralogy, Chemical precipitation, Hydrogen ion concentration, Oxidation-reduction potential, Al-kalis (Bases), Volcanoes, Sulfides, Organic matter. Identifiers: \*USSR, Transbaykal, Central Asia, Ural Mountains, Kamchatka, Dispersion halos, Fumaroles, Mineralization, natural water, Hydrogeochemistry.

Aqueous dispersion halos of the gold deposits of Eastern Transbaykal, Central Asia, Southern Urals and Kamchatka are largely the product of sulfuric acid, carbonic acid and hydrolytic decomposition of gold-containing minerals. The gold content in aqueous halos varies between 0.05 and 10 micrograms/liter. In natural waters with a pH of 5-8 and Eh of 0.1-0.5 volts, gold migrates in the form of uncharged particles and complex organic com-pounds. In the presence of thiosulfate ions gold may form extremely stable thiosulfate complexes. Chloride and bromide complexes of gold can be formed only in strongly acidic waters with an Eh greater than 0.9 volts and a pH of less than 1. Under natural conditions these types of waters are found only in hydrochloric-acid fumaroles of active volcanoes. A sulfuric acid medium is unfavorable for the migration of gold; thus, the gold content in interstitial waters of intensively oxidized gold-sulfide deposits does not exceed 0.1-0.15 micrograms/liter. Judging from the composition of new formations of gold deposits in the supergene zone and from correlations with other chemical elements in natural waters, the most common coprecipitators of gold are iron hydroxides, calcium carbonate, disulfides and colloidal silicic acid. (Josefson-USGS)

INFLUENCE OF VOLCANIC ROCKS ON THE COMPOSITION OF HYDROTHERMAL SOLU-TIONS (RUSSIAN: VLIYANIYE VUL-KANOGENNYKH POROD NA SOSTAV GIDROTERMAL'HYKH RASTVOROV), Akademiya Nauk SSSR, Moscow. Institut Geok-himii i Analiticheskoi Khimii.

N. I. Khitarov, A. G. Khundadze, E. E. Senderov, and N. P. Shibayeva.

Geokhimiya, No 6, p 678-692, June 1970. 15 p, 8 fig, 5 tab, 32 ref.

Descriptors: \*Igneous rocks, \*Water chemistry, \*Chemical analysis, \*Aqueous solutions, Geochemistry, Petrography, Alkali metals, Hydrogen ion concentration, Alkalinity, Acidity, Silica, Chlorides, Calcium. Identifiers: \*USSR, \*Georgian SSR, Hydrothermal

solutions.

An examination is made of the interaction of water and various aqueous solutions with volcanic rocks and various addeous solutions with voicanic rocks collected in the Georgian SSR and with artificial glasses prepared from the rocks at temperatures of 200 deg and 300 deg C and 300 atm. The relative decomposition rate for acidic and basic igneous rocks exposed to water and chloride solutions of sodium, potassium and calcium is approximately the same and decreases for basic solutions. The total concentration of the solution obtained after interaction with the rocks increases as the solution changes from water to chloride and thence to basic solutions. Silica-saturated solutions result from interaction of water with volcanic rocks containing amorphous glassy material. The principal components of rocks entering neutral and basic solu-tions are silica and alkalis; alumina, iron and magnesium are generally only slightly mobile and are accumulated in the residual solid phase. Volcanic rocks in interaction with basic solutions assume a buffer role: the pH of the end solutions approaches 7.0 and does not deviate from neutral by more than 2-3 units. (Josefson-USGS) W71-09120

HYDROGEOCHEMISTRY OF SEDIMENTARY (INTERSTITIAL) BRINES OF SALT DEPOSITS (RUSSIAN: K GIDROGEOKHIMII SEDIMEN-TATSIONNYKH RASSOLOV SOLYANYKH MESTOROZHDENIY),

G. V. Bel'tyukov.

Geokhimiya, No 9, p 1131-1135, Sept 1970. 5 p, 1 fig, 4 tab, 13 ref.

Descriptors: \*Brines, \*Salts, \*Geochemistry, Chemical analysis, Saline water, Magnesium, Chlorine, Calcium, Potassium, Specific gravity. Identifiers: \*USSR, Hydrogeochemistry, Salt deposits, Mineralization, Bromine.

The composition of brines of several rock salt and potassium deposits of the USSR is examined. Although sedimentary (interstitial) brines represent partially metamorphosed brines, their chemical composition in the various deposits is basically the same. All brines are of the chloride type and have a high mineralization, a high specific gravity, high magnesium and bromine contents, and a low sodium content with respect to contact leaching brines. The calcium content is directly dependent upon the degree of brine metamorphism. The presence of iron and lithium is typical of the interstitial brines of some deposits. The brines often contain methane, hydrogen sulfide and nitrogen gases. The intraformational waters of salt rocks examined are, by their nature and formation conditions, buried sedimentary (Interstitial) brines. (Josefson-USGS) W71-09121

THE STUDY OF THE PHYSICAL, CHEMICAL AND BIOLOGICAL NATURE OF WATER QUALITY UNDER UTAH CONDITIONS,

Utah State Univ., Logan.
For primary bibliographic entry see Field 05A.
W71-09268

WATER ANALYSIS,

Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.

ORIGIN OF PACIFIC OCEAN IRON-MAN-GANESE NODULES FROM RADIOISOTOPE (RUSSIAN: PROISKHOZHDENIYE ZHELEZO-MARGANTSEVYKH KONKRETSIY TIKHOGO OKEANA PO DANNYM O RADIOIZOTOPAKH), Akademiya Nauk SSSR, Moscow. Geologicheskii

For primary bibliographic entry see Field 05A. W71-09306

PHREATIC VERSUS VADOSE METEORIC DIAGENESIS OF LIMESTONES: EVIDENCE FROM A FOSSIL WATER TABLE,
Texas Univ., Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.

LATE PLEISTOCENE DIAGENESIS DOLOMITIZATION, NORTH JAMAICA,

Texas Univ., Austin. Dept. of Geological Sciences; and California Inst. of Tech., Pasadena. Div. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W71-09317

#### 2L. Estuaries

REVIEW OF THE FEDERAL WATER QUALITY ADMINISTRATION ESTUARINE FINDINGS,

Environmental Protection Agency, Boston, Mass.

Water Quality Office.
For primary bibliographic entry see Field 05G.
W71-08945

SIMULATION OF TIDAL MOTION IN COMPLEX RIVER SYSTEMS AND INLETS BY A METHOD OF OVERLAPPING SEGMENTS,

Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch. R. F. Henry.

Department of Energy, Mines and Resources, Marine Sciences Branch Manuscript Report Series No 17, 1971. 30 p, 11 fig, 4 ref.

Descriptors: \*Tidal waters, \*Water circulation, \*Tides, \*Water level fluctuations, \*Inlets (Waterways), \*Model studies, Numerical analysis,

#### Water Yield Improvement—Group 3B

Analytical techniques, Turbulent flow, Turbulent boundary layers, Coasts, Rivers, Oceans, Break-

Identifiers: \*Tidal motion.

A method is proposed to facilitate digital and hybrid computation of tidal motions for a coastal inlet or river system in which there are many bifurcations, confluences, islands, etc. The inlet is divided into overlapping segments and the tidal movided into overlapping segments and the total mo-tion is computed for each segment separately over a time increment short enough to ensure that errors due to neglect of neighboring segments are con-fined to the regions of overlap. The tidal motion for the whole inlet at the end of each time increment is found by discarding erroneous portions of the solutions for the various segments and piecing together the remaining parts. A simple numerical experi-ment was used to test the validity of the proposed method in a known physical situation and to com-pare various methods of linking adjacent segments. (Woodard-USGS)

PRELIMINARY INVESTIGATION OF THE SURFICIAL SEDIMENTS IN THE CAP-BRETON CANYON (SOUTHWEST FRANCE) AND THE SURROUNDING CONTINENTAL SHELF, Institut de Geologie du Bassin d'Aquitaine, Talence

For primary bibliographic entry see Field 02J. W71-09100

INTERNATIONAL MICROBIOLOGICAL CONGRESS, (In Russian), For primary bibliographic entry see Field 02H.

#### ANALOG SIMULATION OF POPULATION AGE STRUCTURES,

Maryland Univ., Solomons.

Donald R. Heinle.

University of Maryland, Natural Resources Institute, Chesapeake Biological Laboratory report, Sep 1970. 19 p, 6 fig, 2 tab, 10 ref. OWRR Project No A-002-MD (9).

Descriptors: Simulation analysis, Analog computers, Population, Age, Mortality, Copepods,

Crustaceans. Identifiers: \*Acartia tonsa, \*Steady-state demographic equations.

A simulation of population age structures was shown by the use of analog computers with steady state-demographic equations. The survivorship curve of a wild population of the calanoid copepod, Acartia tonsa, was observed to be very close to a negative exponential function, in spite of the fact that many of the known predators selected older copepods. The question examined of whether a small amount of selective predation would alter the age structure of the copepod population in a recognizable way. Of major importance was the fact that while a non-selective mortality did not alter the birthrate, b, or the stable age distribution, Cx, a selective mortality did. (Veverka-Cornell) W71-09214

# SYSTEMS OF ENGINEERING AND DEVELOP-MENT OF COMMERCIALLY VALUABLE MARINE RESOURCES IN THE DELAWARE

REGION,
Delaware Univ., Newark. Coll. of Marine Studies. W. S. Gaither, D. L. Maurer, J. R. Mather, D. R. Harman, and T. H. Williams.

Available from the National Technical Information Service as PB-198 082, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Project Final Report, Dec

Descriptors: \*Aquatic producitivity, \*Oysters, \*Foods, \*Economic feasibility, Delaware, Cost analysis, Simulation analysis, Marine animals.

Identifiers: \*Aquaculture, \*Seafood industries, \*Economic development, Computerized simulation, Cost estimates, Biology, Education, Hybridization, Systems engineering, Sea Grant project, \*Marine resources.

Revival of Delaware's oyster industry was emphasized. A systems engineering study provided a computer simulation of a closed environment oyster plant which will be used to design the plant and analyze the effect of changes on investment and operating costs. Practical procedures were developed for breeding oysters including command spawning, supplemental feeding and environmental control; all necessary for the design of a commercial oyster hatchery with the potential for a lengthened spawning season and accelerated growth rate of larvae. This program also strengthened the faculty and curricula in Marine Science and Engineering and contributed materially to the decision to establish the College of Marine Studies. W71-09259

## MERCURY IN A COASTAL MARINE EN-VIRONMENT, Southampton Univ. (England).

For primary bibliographic entry see Field 05A.

#### HYDROLOGY OF COASTAL WATERS,

Texas A and M Univ., College Station; and Texas Engineering Experiment Station, College Station.
Coastal and Ocean Engineering Div.
Lawrence E. Newbolt, and John B. Herbich.

Available from National Technical Info Service, Operations Division, Springfield, Virginia, 22151, as PB-197 628, \$3.00 in paper copy, \$0.95 in microfiche. Hydrology of Coastal Waters, Coastal and Engineering Division Report No 133, Aug 1970.91 p, 18 fig. 40 ref. Sea Grant Publication No TAMU-SG-70-225.

Descriptors: \*Coasts, \*Estuaries, \*Tidal marshes, \*Hydrologic data, \*Saline water intrusion, \*Silting, Temperature, Dissolved oxygen, Phosphorus, Nitrogen, Mixing, Currents, Tides, Runoff, Inflow, Evaporation, Rainfall, Geology.

Selected literature on coastal and estuarine hydrology is reviewed and summarized. An estuary is defined and the hydrologic data collection, salinity intrusion, siltation, hydrologic implications of deepwater channels are presented in detail for tidal estuaries. Suggestions for further research are made. (Ensign-PAI) W71-09365

# WHAT'S HAPPENING TO OUR SALT WATER

MARSHES, New York State Dept. of Environmental Conservation, Albany. Div. of Marine and Coastal Resources.

For primary bibliographic entry see Field 06G. W71-09410

#### 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

INVARIANT IMBEDDING, LINEARIZATION, AND MULTISTAGE COUN-TERCURRENT PROCESSES III. ESTIMATION AND THE OVER-DETERMINED SYSTEM, Kansas State Univ., Manhattan. Dept. of Industrial

Engineering. For primary bibliographic entry see Field 06A. W71-09219

SALINE WATER CONVERSION ACT OF 1971 (A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONTINUE RESEARCH AND DEVELOPMENT FOR THE TREATMENT OF SALINE AND OTHER CHEMICALLY CONTAMINATED WASTE WATER TO MAINTAIN OR IMPROVE THE QUALITY OF WATER).

For primary bibliographic entry see Field 06E. W71-09435

#### 3B. Water Yield Improvement

# SIMULATION OF WATER YIELD FROM DEVEGETATED BASINS, Hydrocomp International, Palo Alto, Calif.

George Fleming.

Journal of the Irrigation and Drainage Division, ASCE, Vol 97, No IR 2, Proc Paper 8175, p 249-262, June 1971. 14 p, 5 fig, 7 tab, 9 ref, 2 append.

Descriptors: \*Drainage, \*Irrigation, \*Vegetation, \*Watersheds (Basins), Computers, Mathematical models, Management, Rivers, Simulation analysis,

Water yield.
Identifiers: \*Sisquoc River, \*Santa Ynez River,
Devegetated basins.

The application of a model called Hydrocomp Simulation Program for water shed simulation was considered with specific reference to studying the effects of vegetation management on water yields. In addition, other features of the highly interactive problem of water resources were highlighted in the form of sediment transport and water quality changes. If the balance of nature is altered, a chain reaction occurs. Examples were presented where the effects of wild forest fires on water yield were demonstrated quantitatively for the Sisquoc and Santa Ynez Rivers in California. The results of this study were then extended to determine the long term effect of planned vegetation management on both watersheds for the complete period of streamflow record. The results were presented and showed conclusively that the removal of vegetation for a watershed increases the water yield. (Veverka-Cornell) W71-09001

# NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY: APPENDIX D - GEOLOGY AND GROUND WATER (FINAL DRAFT), Geological Survey, Arlington, Va. and Geological Survey, Hartford, Conn.

D. J. Cederstrom, John A. Baker, and George R.

North Atlantic Regional Water Resources Study Coordinating Committee Report, March 1971. 240 p, 17 fig, 2 plate, 14 tab, 34 ref.

Descriptors: \*Water resources development, \*Northeast U. S., \*Hydrogeology, \*Water yield, \*Groundwater, Conjunctive use, Surface-groundwater relationships, Aquifers, Aquifer characteristics, Coastal plains, Glacial drift, Water wells, Safe yield, Water quality. Identifiers: North Atlantic Region (U. S.).

Large volumes of groundwater, from a few million to several tens of millions of gallons a day per well field, are available in the North Atlantic Region in much of the Coastal Plain; in belts of sandstone and carbonate rock (limestone and dolomite), particularly where these have been folded and faulted; and in glacial sand and gravel beds, generally adjacent to rivers and large streams. The average yield of wells in sandstone and carbonate rock is, respectively, 150 and 300 gpm. In favorable locations, wells in Coastal Plain sediments may yield in excess of 2,000 gpm and many wells in glacial deposits yield more than 700 gpm. Smaller quantities of groundwater, generally less than 75 gpm, are available from wells throughout the region in areas underlain by crystalline rocks and shale. The total volume of groundwater available in each basin is estimated and shown in tables. The quality of groundwater is generally good. (Knapp-USGS)

# Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3B-Water Yield Improvement

W71-09106

A PRELIMINARY EVALUATION OF BANK STORAGE ASSOCIATED WITH LIBBY RESER-VOIR IN NORTHWESTERN MONTANA, Geological Survey, Washington, D.C.

Donald L. Coffin.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-Price 25 cents. Geological Survey Water-Supply Paper 1899-L, 1970. 25 p, 7 fig, 3 tab, 3 ref.

Descriptors: \*Bank storage, \*Reservoirs, \*Aquifer characteristics, \*Water table, \*Montana, Model studies, Analog models, Hydrogeology, Aquifers, Reservoir yield, Groundwater, Transmissivity, Storage coefficient, Reviews, Reservoir construc-

Identifiers: \*Libby Reservoir (Mont), Reservoir morphology.

Permeable sand and gravel deposits beneath the floor of the Rocky Mountain Trench in northwestern Montana and Southeastern British Columbia will become saturated and provide additional storage for Libby Reservoir, which is scheduled to begin filling in 1972. Because subsurface geologic data are insufficient to predict accurately the amount of usable bank storage, plans cannot be made to use this water for project purposes. An electric analog of the area is too crude to make final estimates of bank storage, but the model study points out that the distribution of active bank storage along the reservoir is mainly a function of storage atong the reservoir is mainly a function of the size and shape of the reservoir stage hydro-graph and of the slope of the floor of the reservoir. The magnitude of active bank storage is controlled by transmissivity and storage coefficient. The model study indicates that geologic data necessary to evaluate bank storage accurately need only be collected over about one-fourth of the length of the reservoir and within about 2 miles of its edge. The study allowed the estimated cost of the data collection plan to be reduced by about half. (Woodard-USGS) W71-09137

A GUIDE TO AQUATIC SMARTWEEDS (POLYGONUM) OF THE UNITED STATES, Virginia Polytechnic Inst., and State Univ., Blacksburg. Dept. of Biology. For primary bibliographic entry see Field 05G. W71-09151

PRODUCTION, MINERAL NUTRIENT ABSORPTION, AND BIOCHEMICAL ASSIMILATION BY JUSTICIA AMERICANA AND ALTERNANTHERA PHILOXEROIDES,

Auburn Univ., Ala. Agricultural Experiment Sta-

For primary bibliographic entry see Field 05C. W71-09178

A PLASTIC BARRIER FOR SPOT TREATMENT OF AQUATIC VEGETATION, Texas Parks and Wildlife Dept., Waco

For primary bibliographic entry see Field 05C.

LARGE SCALE EFFECTS OF CLOUD SEED-ING. 1969-70 SEASON AND TWO YEAR SUM-MARY, Aerometric Research, Inc., Goleta, Calif.

Keith J. Brown, and Robert D. Elliott. Available from the National Technical Information

Service, \$3.00 in paper copy, \$0.95 in microfiche. Bureau of Reclamation Contract Report ARI-70-20, Oct 1970. 25 p.

Descriptors: \*Artificial precipitation, Meteorological instruments, Sampling, Wind, California, \*Cloud seeding, \*Weather modification. Identifiers: Statistical analysis, Periodic variations, Air mass analysis, Atmospheric precipitation.

This report covers the results of two years of field testing to determine the existence, magnitude and causes of large scale effects of cloud seeding. The field program was located north and east of an ongoing research seeding project by North American Weather Consultants under contract to the Naval Weapons Center. Substantial evidence is presented showing that precipitation has been more than doubled over a large area about 70 miles downwind from a point seeding source in Santa Barbara County, California. The causes of those increases have not yet been determined, but preliminary results indicate they are related to air mass temperature and wind speed and direction.
W71-09265

DRAINAGE MAINTENANCE AND RECONSTRUCTION COSTS AND BENEFITS: A WATERSHED ANALYSIS,
Manitoba Univ., Winnipeg. Dept. of Agricultural Economics and Farm Management.
James A. MacMillian, and Geoffrey A. Norton.

Canadian Journal of Agricultural Economics, Vol 18, No 3, p 56-63, Nov 1970. 1 figure, 7 references.

Descriptors: \*Drainage programs, \*Cost-benefit analysis, \*Regression analysis, \*Economic efficien-

Identifiers: \*Interlake Area of Manitoba, Icelandic watershed, Fund for Rural Economic Develop-

This paper attempts to identify and apply economic criteria to the drainage process in the Interlake area of the province of Manitoba. The shortcomings of resource modification decisions based on single use concepts and the need for including pervasive drainage effects on the economy are outlined. A regression model, utilizing the important variables involved in drainage reclamation account for the major portion of the variation in benefits among farms. Although a cost-benefit figure of 1:6 is estimated, its interpretation is constrained by the particular economic relationship investigated, the partial nature of the analysis and the desirability of the distribution of drainage benefits. Drainage is a means of distributing income to low income farmers even though large farms receive the greatest share of benefits. (Holmes-Rutgers)

#### 3D. Conservation in Domestic and Municipal Use

PUBLIC AND INDUSTRIAL WATER SUPPLIES IN SOUTHERN MISSISSIPPI,

Geological Survey, Jackson, Miss. For primary bibliographic entry see Field 07C. W71-09091

HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI RIVER.

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 02E. W71-09103

### 3E. Conservation in Industry

PUBLIC AND INDUSTRIAL WATER SUPPLIES IN SOUTHERN MISSISSIPPI,

Geological Survey, Jackson, Miss. For primary bibliographic entry see Field 07C.

#### 3F. Conservation in Agriculture

IDENTIFICATION OF IRRIGATION RETURN WATER IN THE SUB-SURFACE, PHASE III: KAHUKU, OAHU AND KAHULUI AND LAHAINA, MAUI, Hawaii Univ., Honolulu. Water Resources For primary bibliographic entry see Field 05B. W71-08972 Research Center.

RAINFALL USE EFFICIENCY FOR DRYLAND BARLEY WITH THREE CROP AND WATER MANAGEMENT SYSTEMS,

Agricultural Research Service, Riverside, Calif.; and California Univ., Riverside. R. E. Luebs, and A. E. Laag.

Soil Science Society of America Proceedings, Vol 35, No 2, p 336-339, Mar-Apr 1971.

Descriptors: \*Water utilization efficiencies, \*Watermanagement (Applied), \*Dry farming, Ponding, Water storage, Moisture availability, \*Barley, Growth stages, Fallowing, Farm management, Crop production.

Identifiers: \*Rainfall use efficiency, \*Runoff con-

centration, Winter rainfall distribution.

Three crop and water management systems for barley (Hordeum vulgare L.) were compared in a winter rainfall climate on Hanford sandy loam. These systems were (1) annual cropping with runoff retention, (2) a fallow-crop sequence with runoff retention, and (3) induced runoff on one-half the area for concentration and annual cropping on the remaining half. Land slope was 2-3% and runoff was retained with dikes at 7.6-m intervals in the first two systems. Over a 3-year period average grain yields were 1.58, 2.04, and 2.29 ton/ha with rainfall use efficiences of 41, 29, and 31 kg/ha-cm for annual cropping, fallow-crop, and induced runoff concentration systems, respectively. The additional soil water in downslope areas of the annual and fallow-crop systems and in areas receiving induced runoff was reflected in increased barley kernels per head and greater kernel weight. Holding runoff on the land and cropping annually increased rainfall use efficiency 42% over both that obtained where runoff occurred in the annual cropping system and that obtained for the entire plot area in the fallow-crop system. The efficiency of fallow for storing water in the soil was 16.7%. (Luebs-USDA) W71-08975

ESTIMATION AND USE OF WATER PRODUC-TION FUNCTIONS IN CROPS.

Hebrew Univ., Rehovoth. Faculty of Agriculture. Dan Yaron.

Journal of Irrigation and Drainage Division, ASCE, Vol 97, No IR2, Proc Paper 8208, p 291-303, June 1971. 13 p, 2 fig, 4 tab, 19 ref, 1 append.

Descriptors: \*Crop response, \*Plants, \*Water consumption, \*Water supply, Agronomy, Irrigation, Planning, \*Irrigation efficiency. Identifiers: Crop yield, Empirical estimation.

By comparing two major theories regarding plant response to water supply and different soil moisture levels (Veihmeyer and Hendrickson; and Furr and Taylor, Hagan et al.), problems of empirical estimation of water production functions in crops were reviewed and the importance of the estimates was illustrated by several examples. The major problem of empirical estimation of such functions was their specification and in particular the choice of the independent variables, the dependent one being the crop yield per land unit. The paper concluded that while production functions with fixed intraseasonal water distribution could be estimated by regression methods, difficulties were involved in the regression approach in the estimation of dated production functions. An attempt to conceptualize the plant growth in the framework of process analysis, aimed at the derivation of growth rules was suggested. (Veverka-Cornell) W71-08997

#### Conservation in Agriculture—Group 3F

#### HEATED EFFLUENT - AN ASSET TO AGRICULTURE, Washington State Office of Nuclear Energy

Development, Seattle.
For primary bibliographic entry see Field 05C.

**w7i-**09028

# AUTO-MECHANIZATION OF PIPE DISTRIBUTION SYSTEMS,

TION SYSTEMS,
Department of Agriculture, Fort Collins, Colo; and Nebraska Univ., Lincoln.
H. R. Haise, and P. E. Fischbach.
American Society of Agricultural Engineers National Irrigation Symposium Paper, University of Nebraska, Lincoln, Nov 1971, p M-1-M-15, 15 p, 14-5a, 24-b, 13-ref. 14 fig, 2 tab, 13 ref.

Descriptors: \*Automatic control, Mechanization, Irrigation, Irrigation systems, \*Water reuse, \*Irrigation efficiency, Control systems, Sensors, Irrigation rigation engineering, Water distribution (Applied), Pipelines, \*Furrow irrigation, Distribution systems, Sprinkler irrigation, Soil water, Cost comparisons, Remote control, Costs, Tensiometers.

In the last 5 yr, the major effort in automation of pipeline surface irrigation systems has been in the development of: (1) a closure or diaphragm that could automate pipe valves or outlets, (2) reliable controllers for remote operation, (3) improved design of automatic valves, and (4) design of reuse systems adapted to automatic irrigation pipelines to achieve higher application efficiencies by recirculating runoff water. As a result, a reliable automated surface irrigation system has been developed. The estimated cost of the system is comparable to self-propelled center pivot and less than automated solid-set sprinkler systems. The power requirements for operating a sprinkler irrigation system are considerably greater. Automated surface irrigation systems adapt best to slopes of less than 1.5%, and to soils with a medium to low intake. The reuse of runoff water is an integral part of the system. A combination of reuse and automatic surface-pipe irrigation systems has resulted in high water application efficiency and uniformity coefficient. Automated surface irrigation pipe with a reuse system can be used efficiently to apply fertilizers because high coefficients of uniformity are attained and the runoff water is reused. (USBR)
W71-09068

# **AUTO-MECHANIZATION OF OPEN CHANNEL**

DISTRIBUTION SYSTEMS,
Department of Agriculture, Kimberly, Idaho.; and
Department of Agriculture, Fort Collins, Colo.;
and Oklahoma State Univ., Stillwater.

A. S. Humpherys, J. E. Garton, and E. G. Kruse. American Society of Agricultural Engineers National Irrigation Symposium Paper, University of Nebraska, Lincoln, p L-1--L-20, Nov, 1970. 20 p, 10 fig, 20 ref.

Descriptors: \*Irrigation, Irrigation design, Irrigation systems, Check structures, Irrigation efficiency, \*Automatic control, Orifices, Valves, \*Distribution systems, Furrow irrigation, Bibliographies, Weirs, Gates, Tensiometers, Water distribution (Applied), Sensors.

Auto-mechanization enables an irrigation farmer to apply water more efficiently with minimum labor using automatic and semiautomatic control devices. Semiautomatic systems require manual attention during each irrigation while automatic systems normally operate without attention. In designing channels for automatic furrow irrigation, the distribution functions are considered using procedures developed for computing decreasing varied flow. Water is usually distributed into in-dividual furrows using furrow tubes, orifices, or weirs in the side of open channels. Semiautomatic structures include: checks, dams, normally closed gates, normally open gates, and portable and mo-bile equipment. Many structures are controlled by mechanical timers. Automatic irrigation equipment

using external power for operation such as electricity or fluid pressure includes pneumatic lay-flat valves and hydraulically operated gates and valves that are often controlled by programmed timers or controllers. Structures utilizing energy of the flow-ing irrigation stream include center-of-pressure gates, sinking float gates, and fluid diverters.
(USBR)
W71-09069

DESIGN CRITERIA FOR IRRIGA SYSTEMS WITH COMPLEX PIPE LOOPS. IRRIGATION Nebraska Univ, Lincoln.

For primary bibliographic entry see Field 04A.

# IRRIGATION OF WINTER WHEAT IN THE ROSTOV OBLAST (RUSSIAN: REZ OROSHENIYA OZIMOY PSHENITSY ROSTOVSKOY OBLASTI),

V. A. Kozin.

Gidrotekhnika i Melioratsiya, No 12, p 65-69, Dec 1970. 5 p, 2 tab, 5 ref.

Descriptors: \*Irrigation systems, \*Surface irriga-tion, \*Sprinkler irrigation, \*Wheat, Irrigation water, Furrow irrigation, Crop production, Meteorological data.
Identifiers: \*USSR, \*Rostov Oblast, Sprinklers.

Experiments were conducted in the Rostov Oblast in 1964-68 to study the effectiveness of fall surface irrigation of winter wheat and to compare it with the effectiveness of pre- and post-planting sprinker irrigation. Experiments were conducted in six variants: (1) a control experiment without irrigation; (2) furrow surface irrigation before planting; (3) furrow surface irrigation after planting; (4) sprinkler irrigation before planting; (5) sprinkler irrigation after planting; and (6) sprinkler irrigation after planting plus one sprinkler irrigation during the growing season. The increase in yield from a fall surface irrigation of the soil was 150-220% of the yield obtained in the control experiment. Sprinkler irrigation after planting of wheat produced higher increases in grain yield than irrigation prior to planting. Maximum yields of winter wheat were obtained when 1-2 sprinker irrigations during a growing season were conducted in addition to surface irrigation. To establish a large base for grain production on irrigation lands of the oblast, it is necessary to construct hydraulic structures below the Tsimlyansk reservoir for regulating Don River runoff and build an additional conduit on the Don canal; these measures will make it possible to increase grain production by as much as sevenfold over the present (1968) figure. (Josefson-USGS) W71-09131

## IRRIGATION METHODS FOR MEADOWS AND PASTURES (RUSSIAN: TEKHNIKA POLIVA LUGOV I PASTBISHCH),

A. M. Polonskiy, M. V. Sokolovskaya, and S. N. Nikulin.

Gidrotekhnika i Melioratsiya, No 12, p 24-32, Dec 1970.9 p, 9 fig.

Descriptors: \*Irrigation practices, \*Grasslands, \*Pasture management, \*Sprinkler irrigation, \*Equipment, Irrigation water, Fertilizers, Farms wastes, Soil properties. Identifiers: \*USSR, Sprinklers, Liquid manure.

Basic factors to be considered in selecting irrigation methods for meadows and pastures include the surface-water source, field size, configuration and relief of fields, optimal size of corrals, obstacles impeding movement and relocation of equipment, a soil's water-physical properties and the composi-tion of the grass stand. Before irrigating, a pasture must be marked off into strips, taking into account the layout of the irrigation network, operating width of the equipment, its variable output, etc. The economic effectiveness of meadow and pasture irrigation may be increased by applying fer-tilizers along with irrigation water. Application of

one ton of liquid value to provide a yield increase of 50-80 feed units (equal in nutritional value to 50-80 kg of oats), which, when calculated for one hectare, will equal a yield increase of 1,000-2,000 feed units. Sprinklers and pumps under development in the USSR will provide for simultaneous application of liquid manure and irrigation water to crop rotation fields. Series production of two American-made sprinklers is contemplated follow-ing extensive testing in the Volga River region, Ukraine and Moscow Oblast. (Josefson-USGS)

# IRRIGATION AND UTILIZATION OF IRRIGATED LANDS IN THE ASTRAKHAN' OBLAST (RUSSIAN: OROSHENIYE I ISPOL'-COVANIYE OROSHAYEMYKH ZEMEL' V ASTRAKHANSKOY OBLASTI), V. S. Bondarev, and V. Ye Viktorov. Gidrotekhnika i Melioratsiya, No 12, p 18-23, Dec

1970. 6 p, 4 tab.

Descriptors: \*Irrigation practices, \*Irrigated land, \*Crop production, Irrigated water, Sprinkler irrigaertilizers, Farms wastes, Soils, Vegetable

crops, Rice, Melons. Identifiers: \*USSR, \*Astrakhan' Oblast, Sovk-hozes, Kolkhozes, Sprinklers, Irrigation agricul-

The natural economic conditions of the Astrakhan' Oblast are favorable for the cultivation of crops and have contributed for years to the development of irrigation agriculture. Although the crop lands under irrigation occupy only 25% of the entire sowing area, they provide 85-88% of total crop production. Recently, more than 42,000 ha of new irrigation land have been cropped, including 21,900 ha for rice crop rotations. A total of 935,000 ha of acture land have been supplied with irrigation. pasture land has been supplied with irrigation water. Of the total area of irrigation land (105,000 ha), 65,000 ha have an irrigation network. Sprinkler irrigation is becoming increasingly common on kolkhoz and sovkhoz lands of the oblast. The extent of agricultural lands under sprinkler irrigation has increased from 3,300 ha in 1963 to 49,700 ha in 1969. Practices employed at kolkhozes and sovkhozes have demonstrated the high economic effectiveness of fertilizer application. When 10-12 cntr of mineral fertilizers/ha were applied, the yield of unpolished rice increased by 15-20 cntr/ha,/ that of vegetables by 200-250 entr/ha, and that of watermelons by 150-200 entr/ha. (Josefson-USGS) W71-09133

LAND RECLAMATION AND COMPLEX USE OF WATER RESOURCES (RUSSIAN: MELIORATSIYA ZEMEL' I KOMPLEKSNOYE ISPOL' ZOVANIYE VODNYKH RESURSOV), For primary bibliographic entry see Field 04A. W71-09134

# A STUDY OF PRECIPITATION, STREAM-FLOW, AND WATER USAGE ON THE UPPER RIO GRANDE,

Environmental Science Services Admin., El Paso, Tex.; and Bureau of Reclamation, El Paso, Tex. For primary bibliographic entry see Field 02A. W71-09310

# ECONOMICS IN SOIL AND WATER CONSER-

VATION, lowa State Univ., Ames. Dept. of Economics. John F. Timmons.

Agricultural Engineering, Vol 51, No 6, p 364-366, June 1970. 4 figures.

Descriptors: \*Water, \*Conservation, \*Soil conservation, \*Economic justification, Optimum development plans, \*Planning.

This article discusses economic criteria for selection of soil and water practices for optimal use of public funds for conservation in the context of changing technologies. Although these new

# Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

## Group 3F—Conservation in Agriculture

technologies are increasing the range of practices for conserving soil and water resources, evaluation that will help maximize the satisfaction of consumer demands at the lowest per unit output cost over time remains an important and continuing challenge. (Holmes-Rutgers)
W71-09394

**AGRICULTURAL METEOROLOGY** IN PLANNING.

Department of Agriculture, Ottawa (Ontario). Plant Research Inst.

Wolfgang Baier.

Canada Agriculture, Vol 16, No 4, p 30-32, Winter 1971. 3 fig, 1 tab.

Descriptors: \*Climatology, Forecasting, \*Model studies, \*Soil water, Cost analysis, Crop produc-

Identifiers: \*Canada.

Canadian research in applied climatology has made it possible to classify existing and prospective agricultural areas, to estimate the potential production of crops, and to assess future economic benefits of specific farming systems. By combining the estimated variations of spring soil moisture and seasonal rainfall with results from field experiments on soil water usage and from economic surveys of production costs, it is possible to generate probable net returns for a variety of crops and management systems. (Holmes-Rutgers) W71-09428

#### 04. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control of Water on the Surface

FIELD TESTS OF ICE PREVENTION TECHNIQUES,

Corps of Engineers, Anchorage, Alaska. Alaska

Julius H. Moor, and Carl R. Watson

Proceedings of the American Society of Civil Engineers, Jouranl of the Hydraulics Division, Vol 97, No HY6, Paper 8179, p 777-789, June 1971, 13 p. 15 fig, 5 ref.

Descriptors: \*lce jams, \*Flood control, \*Ice breakup, \*Rivers, \*Alaska, Albedo, Hydraulics, River basin development, Melting, Ice, Freezing. Identifiers: \*River ice control.

The U.S. Army Corps of Engineers, Air Force, and the State of Alaska conducted a field research program in Alaskan rivers to find an economical and reliable technique for reducing ice jams and consequent flood frequencies. Procedures based upon principles described by previous researchere were: (a) Aerial dusting using fly ash which created a shear line along which the ice broke up more readily. (b) Pumping of river bottom materials onto the ice surface which decreased the albedo. (c) Cutting holes in the ice by blasting to utilize pressure flow of subsurface water produced by increased run-off of spring thaw to overflow parts of the ice cover with warmer river water. The costs in manpower, equipment, and materials are shown for each procedure. The results show that dusting through absorption of incident isolation will result in increased melt rates of snow and ice. Similar results were obtained with pumped river bottom materials. Pressure flow results will require further research, although the creation of holes in the ice of blasting or other mechanical means appears to be a positive method for creating a shear line which also offers open water to solar exposure and increased melting; however, blasting methods may kill or demand some aquatic organisms. (Cowgill-OWRR) W71-08976

SIMULATION OF WATER YIELD FROM

DEVEGETATED BASINS, Hydrocomp International, Palo Alto, Calif. For primary bibliographic entry see Field 03B. W71-09001

FIELD COMPARISON OF SEVERAL TRENCH AND GRAVEL ENVELOPE DESIGNS,

Bureau of Reclamation, Sacramento; and Califor-

nia Univ., Davis. nia Univ., Davis.
D. A. DeBruyan, W. R. Jonston, and R. B. Duffin.
Paper 70-709, 1970 Winter Meet, American
Society of Agricultural Engineers, Chicago, Ill, Dec
1970. 17 p, 4 fig, 4 tab, 10 ref.

Descriptors: Experimental data, \*Experimental farms, Irrigation water, \*Drainage engineering, Drainage systems, \*Drain tiles, Gravels, Chemical analysis, Polymer concretes, Tile drainage, \*Salt balance, Excess water (Soils), \*Perched water table, Sand drains, Clay pipes, Concrete pipes, Plastic pipes, Performance, California. Identifiers: San Joaquin Valley (Calif).

An 80-acre experimental plot was installed in the San Joaquin Valley of California to test the effects of varying design of several trench and gravel envelope placements on the effectiveness of tile drainage. Information collected from the experimental plot, and theoretical considerations of soil moisture tensions and trench geometry have led to the conclusion that the effectiveness of the gravel envelop depends largely upon the position of the gravel with respect to the tile drain and, to a minor extent, upon the effective trench perimeter. The quantity and position of the gravel placement may also influence peak discharge rates. Data will be gathered for approximately 5 additional years to evaluate more fully the various treatments with respect to water and salt movement and durability of nine materials. (USBR) of pipe materials. (USBR) W71-09054

DESIGN CRITERIA FOR IRRIGA SYSTEMS WITH COMPLEX PIPE LOOPS, IRRIGATION

Nebraska Univ, Lincoln.

D. M. Edwards, and B. Spencer.
Paper 70-723, 1970 Winter Meet, American
Society of Agricultural Engineers, Chicago, Ill,
Dec, 1970. 8 p, 4 fig, 1 tab, 7 ref.

Descriptors: \*Pipelines, Design, Irrigation efficiency, Velocity, Head losses, \*Irrigation systems, Computer applications, Water requirements, \*Sprinkler irrigation, Water distribution (Applied), Water application rate, Water pressure, Topography raphy.

Identifiers: \*Hardy Cross method, Irrigation requirement.

New design analysis becomes necessary as irrigation systems become more complex. The analysis of a simple hydraulic system presents little difficulty, but when more complex systems are developed, the simpler procedure may fail to yield a solution. Uniform water application from irrigation systems on irregular topography such as golf courses, recreational areas, or specialized cropping areas deny simplicity in design. Such is also the case with multi-well fields and newly developed permanent solid set sprinkler, subsurface, trickle irrigation systems, and complex loop networks used in municipal water distribution systems. Upon adapting loop networks to irrigation systems, improved irrigation system design resulted. Loop networks can be solved using the Hardy Cross iterative technique. A procedure for designing irrigation systems involving pipe loop networks is presented. An iterative Hardy Cross analysis was used in the basic design procedure. The method can be programed on a digital computer. (USBR) W71-09074

RAINFALL-RUNOFF-HYDROGRAPH RELA-TIONS FOR NORTHERN LOUISIANA, Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 02A. W71-09087

DETERMINATION OF CHANNEL CAPACITY OF THE FRESNO RIVER DOWNSTREAM FROM HIDDEN DAMSITE, MADERA COUNTY,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 08B. W71-09092

SEEPAGE EFFECT ON CHANNEL BANK STA-

BILITY,
Bureau of Reclamation, Denver, Colo. Hydraulics
Machinery Branch, and Colorado State Univ., Fort
Collins. Dept. of Civil Engineering. Philip H. Burgi, and Susumu Karaki.

ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 97, No IR-1, Paper 7968, p 59-72, Mar 1971. 14 p, 9 fig, 3 tab, 6 ref, append.

Descriptors: \*Alluvial channels, \*Seepage, \*Bank stability, \*Pore pressure, Erosion, Tractive forces, Scour, Erosion control, Hydraulic gradient, Groundwater movement, Open channel flow. Identifiers: \*Channel bank stability.

Canal side slope stability is related to groundwater hydraulic gradient, channel flow velocity and initial side slope angle. A quantitative, as well as qualitative, investigation of channel side slope stability is based on an experimental investigation of a trapezoidal channel in a laboratory flume. Various combinations of the variables were tested to determine binations of the variables were tested to determine the effect of seepage on channel side slope stability with various hydraulic and geometric conditions in the channel. An empirical relationship was developed for side slope seepage, expressing the erosion of the side slope as a function of hydraulic gradient and flow velocity in the channel. At relatively low velocities (less than 1 ft per sec) the erosion of the side slope is due primarily to the hydraulic gradient. At higher channel velocities, the side slope erosion is a function of channel flow velocity as well as the groundwater hydraulic gradient. (Knapp-USGS) W71-09110

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN PENNSYLVANIA.

Corps of Engineers, Philadelphia, Pa. North Atlan-

Army Corps of Engineers Water Resources Development Report, Jan 1971, 104 p, 1 fig, 1

Descriptors: \*Water resources development, \*Pennsylvania, \*Surface waters, \*Projects, Reviews, Project planning, Flood control, Beach erosion, Navigation, Water supply, Bank stabiliza-

Identifiers: \*U.S. Army Corps of Engineers.

Current information on the scope and progress of water resources development within the Commonwealth of Pennsylvania by the U.S. Army Corps of Engineers is presented. The projects are concerned with navigation, flood control, beach erosion con-trol, bank protection, and water supply. The Corps' role in planning and building these improvements is described, and the procedure for initiating and processing the improvements is explained. INFOR-MATION IS GIVEN ON THE STATUS OF THE VARIOUS PROJECTS, WHETHER THE WORK IS COMPLETED, IS UNDERWAY, OR HAS NOT BEEN STARTED. (Woodard-USGS) W71-09112

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN THE DISTRICT OF COLUMBIA.

Corps of Engineers, Baltimore, Md. North Atlantic

Army Corps of Engineers Water Resources Development Report, Jan 1971. 23 p, 1 fig, 1 plate, 7 photo.

Descriptors: \*Water resources development, \*District of Columbia, \*Surface waters, \*Projects, Reviews, Navigation, Flood control, Water supply, Rivers, Driftwood, Aquatic drift, Eutrophication, Land reclamation, Planning, Evaluation. Identifiers: \*U. S. Army Corps of Engineers.

This report provides current information on the scope and progress of water resources development (navigation, flood control, water supply, removal of aquatic growth, drift removal, and land reclama-tion) within the District of Columbia by the United States Army Corps of Engineers. The Corps' role in planning and building these improvements and an explanation of the procedure for initiating and processing them are described. Information is given on the status of the various projects, whether the work is completed, is underway, or has not been started. (Woodard-USGS) W71-09113

FLOOD PLAIN INFORMATION ON DAYS CREEK AND TRIBUTARIES AT TEXARKANA, ARKANSAS-TEXAS.

Corps of Engineers, New Orleans, La.

Army Corps of Engineers Flood Plain Report, July 1970. 83 p, 29 fig, 52 plate, 17 tab.

Descriptors: \*Floods, \*Flood damage, \*Arkansas, \*Texas, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood. Identifiers: \*Texarkana (Ark-Tex), Standard pro-

ject flood, Intermediate regional flood.

Flooding along Days Creek and major tributaries in the vicinity of Texarkana, Arkansas-Texas, is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood on record occurred in October 1926, when 9.29 inches of rain fell in a 24-hour period. Floodwaters covered many streets of the city and flooded many homes and business and public establishments in low areas of the cities. (Woodard-USGS) W71-09114

FLOOD PLAIN INFORMATION-CAPE FEAR RIVER AND CROSS CREEK WATERSHED, FAYETTEVILLE, NORTH CAROLINA. Corps of Engineers, Wilmington, N.C.

Army Corps of Engineers Flood Plain Report, Sept 1970. 81 p, 17 fig, 26 plate, 20 tab.

Descriptors: \*Floods, \*Flood damage, \*North Carolina, Flood plains, Regional flood, Flood forecasting, Flood control.

Identifiers: Fayetteville (N C), Standard project flood, Intermediate regional flood, Historic flood.

Flooding along the Cape Fear River and in the Cross Creek watershed in the vicinity of Fayetteville, North Carolina is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. The greatest flood known at Fayetteville dur-ing the past 82 years occurred in September 1945. Newspapers pointed out the disastrous proportions of the flood at Fayetteville, and leave no doubt that it was the most damaging by far of any known to the oldest residents at that time. The greatest known flooding in the Cross Creek watershed occurred due to the backwater effects of the river during the 1945 flood. However, the backwater flooding from the river during the 1945 flood was confined to the lower portion of the Cross Creek watershed. (Woodard-USGS)
W71-09115

LONG-RANGE FORECASTING BREAKUP ON RIVERS OF THE SEVERNYY BREAKUF ON KIYERS OF THE GEVER-KRAY (RUSSIAN: VSKRITIYE REK SEVER-NOGO KRAYA I METODIKA YEGO DOL-GOSROCHNOGO PROGNOZA), For primary bibliographic entry see Field 02C.

W71-09126

CALCULATING RAINFALL RUNOFF LOSSES BY PRECIPITATION AND RUNOFF OF SMALL RIVERS USING THE DNIEPER RIVER-RECHITSA BASIN AS AN EXAMPLE (RUS-SIAN: VYCHISLENIYE POTER' DOZH-DEVOGO STOKA PO OSADKAM I STOKU MA-LYKH REK NA PRIMERE BASSEYNA R. DNEPRA DO G. RECHITSY),

For primary bibliographic entry see Field 02E. W71-09128

CALCULATING MAXIMUM ICE JAM LEVELS OF THE NEVA RIVER (RUSSIAN: RASCHET MAKSIMAL'NYKH ZAZHORNYKH UROVNEY

For primary bibliographic entry see Field 02C.

LAND RECLAMATION AND COMPLEX USE WATER RESOURCES (RUSSIAN: MELIORATSIYA ZEMEL' I KOMPLEKSNOYE ISPOL' ZOVANIYE VODNYKH RESURSOV), A. V. Aleksankin.

Gidrotekhnika i Melioratsiya, No 12, p 9-17, Dec 1970.9 p, 3 fig.

Descriptors: \*Land reclamation, \*Water resources development, \*Soil management, \*Planning, Climatic data, Streamflow, Runoff, Bogs, Saturated soils, Base flow, Drainage systems, Irrigation systems, Reservoirs, Ponds, Fish hatcheries, Erosion control.

Identifiers: \*USSR, \*Belorussia, Poles'ye.

As of January 1, 1970 about 1.6 million ha of land had been reclaimed in the Belorussian SSR with soil improvement methods applied to 800,000 ha. Analysis of the hydroclimatic characteristics of Belorussia for the period 1959-1965 showed that, except for 1962, there was a 15-20% decrease in normal streamflow for the area and as much as a 45-50% decrease in 1964 on rivers of the Poles'ye. In dry years runoff may not occur at all for 3-4 months on rivers with basin areas of 30-75 sq km. According to the Scientific Research Institute on Water Problems, USSR Ministry of Water Management, fluctuations in streamflow in the nonchernozem zone are basically the result of changes in climatic conditions. Reclamation of bogs and waterlogged soils of the area has a generally favorable effect on groundwater flow, especially on minimum and low flow, which are most important in the utilization of water resources of rivers. Plans are underway to expand construction of reservoirs, ponds, fish hatcheries, drainage and irrigation systems throughout the vast area of Belorussia.
(Josefson-USGS) W71-09134

STUDY OF THE RELATIONSHIP BETWEEN ANNUAL RUNOFF OF RIVERS OF THE USSR AND ATMOSPHERIC CIRCULATION (RUS-ZAVISIMOSTI ISSLEDOVANIYE SIAN: GODOVOGO STOKA REK SSSR OT MOSFERNOY TSIRKULYATSII), For primary bibliographic entry see Field 02A. SSSR OT AT-

RIVER BED DEGRADATION,

W71-09136

Asian Inst. of Tech., Bangkok (Thailand). For primary bibliographic entry see Field 08B. W71-09149

IDENTIFICATION AND INTERRELATION-SHIPS OF SECONDARY BENEFITS IN WATER-WAYS DEVELOPMENT, Auburn Univ., Ala. Water Resources Research

For primary bibliographic entry see Field 06B. W71-09269

TALL WHEATGRASS BARRIERS FOR SOIL EROSION CONTROL AND WATER CONSER-VATION,

Agricultural Research Service, Sidney, Mont. Soil and Water Conservation Research Div For primary bibliographic entry see Field 04D.

EVALUATING GEOLOGIC HAZARDS WITH MULTIBAND PHOTOGRAPHY,
San Francisco State Coll., Calif. Dept. of Geology.

For primary bibliographic entry see Field 07B. W71-09304

ESTIMATING MEAN-ANNUAL USING CHANNEL EOMETRY RUNOFF MENTS.

Geological Survey, Carson City, Nev.
Donald O. Moore.
Proceedings of 24th Annual Nevada Water Con-Recedengs of Third Resources and Nevada State Reclamation Association, Sept 24-25, 1970, Carson City, p 40-42, 1970. 3 p.

Descriptors: \*Channel morphology, \*Alluvial channels, \*Stage-discharge relations, \*Runoff forecasting, Stream gages, Gaging stations, Stream-flow, Analytical techniques.
Identifiers: \*Runoff estimation.

In Nevada, the Geological Survey is currently collecting records at 121 full-time gaging stations, 125 crest-stage gages, 10 low-flow partial-record stations, 13 lake and reservoir stations, and about 250 groundwater observation wells. It is often necessary to estimate the mean runoff in ungaged streams by transfer of data where streamflow records are available. But in many areas, particularly in the southwest, the transfer of data is difficult or impossible, and the mean runoff, therefore, has to be determined by other methods. A method of estimating the mean-annual runoff of ungaged streams uses stream-channel measurements. The method is based upon the assumption that channel dimensions adjust themselves to streamflow. Therefore, inspection and measurement of a stream channel should provide evidence of its mean-annual runoff. In developing the method, it was noted that the cross sections in perennial streams were deeper and more narrow than those in ephemeral streams. The ratio of width to depth in perennial streams, in the areas studied, averages about 20 to 1, whereas in the ephemeral streams, the width-depth ratio averaged about 50 to 1. Because of these differences, two sets of curves were developed to estimate the mean-annual runoff: one set for ephemeral streams, and the other for perennial streams. (Knapp-USGS) W71-09313

Army Corps of Engineers Flood Report, Dec 1969. 4 p, 11 plate.

Descriptors: \*Floods, \*Flood damage, \*North Carolina, Flood plains, Flood control, Non-struc-tural alternatives, Maximum probable flood. Identifiers: New Hanover County (NC), Standard project flood, Intermediate regional flood.

Wind-tide flooding of New Hanover County, North Carolina is described in a report of flood plain problems based on records of rainfall, runoff, and

# Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

## Group 4A-Control of Water on the Surface

historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the plain use by Joiling and subdivision regarders, inconstruction of flood protection works, or by combination of these approaches. Wind tides affect the ocean front, the lagoon areas behind the barrier beach system, and the Cape Fear and Northeast (Cape Fear) Rivers. Fifty-four hurricanes have affected the New Hanover County coastline during the 20th century, and wind-tide stages have exceeded 5 feet mean sea level five times since 1954. (Woodard-USGS)
W71-09335

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER, JOHNSON, KELLOGG, AND MT. SCOTT CREEKS, MILWAUKIE-OAK GROVE-LAKE OSWEGO, OREGON. Corps of Engineers, Portland, Oreg.

Army Corps of Engineers Flood Plain Report, May 1970. 55 p, 6 fig, 24 plate, 17 tab.

Descriptors: \*Floods, \*Flood damage, \*Oregon, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood. Identifiers: \*Willamette River (Oregon), Standard Project Flood, Intermediate Regional Flood.

Flooding of the Willamette River and tributaries, Milwaukie, Oak Grove, and Lake Oswego, Oregon, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vul-nerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. The flood of December 1964 was produced by one of the most intense rainfall and snowmelt combinations that has occurred in the Pacific Northwest. Rainfall ranged from 6 to 10 inches over the entire Willamette Basin during the 4-day period, December 19-23. Had there been no upstream storage regulation, a catastrophe would have been experienced. Peak discharges in excess of 100 cubic feet per second per square mile were recorded at many gaging stations in western Oregon. (Woodard-USGS) W71-09336

#### FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, HURON RIVER, NORWALK CREEK,

Corps of Engineers, Buffalo, N. Y.

Army Corps of Engineers Flood Plain Report, May 1970. 23 p, 28 fig, 12 plate, 3 tab.

Descriptors: \*Floods, \*Flood damage, \*Ohio, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood. Identifiers: Huron River (Ohio), Flood records.

Flooding of the Huron River, Ohio, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. The water stage recorder on the Huron River about 500 feet downstream of U. S. Highway 250, 0.25 mile northwest of Milan, Erie County, and two miles downstream of the confluence of the east and west branches was installed

in 1950. The stage at the gage site in July 1969 (31.1 feet) was 7 feet higher than the stage for the January 1959 highwater occurrence (24.1 feet). The discharge in 1959 was 25,800 cfs and it has a recurrence interval in the order of once in 40 years. The 1969 flood has an estimated discharge of 48,900 cfs and it has a recurrence interval in the order of once in 125 years. (Woodard-USGS)

FLOOD PLAIN INFORMATION, QUACHITA-RIVER, BAYOU LAFOURCHE AND TRIBUTA-RIES, MONROE, LOUISIANA. Corps of Engineers, Vicksburg, Miss.

Corps of Engineers Flood Plain Report, June 1970. 57 p, 27 fig, 19 plate, 15 tab.

Descriptors: \*Floods, \*Flood plains, \*Flood damage, \*Louisiana, Historic flood, Regional flood, Flood forecasting, Design flood.

Identifiers: \*Monroe (Louisiana), Ouachita Parish (La.), Standard Project Flood, Intermediate Regional Flood.

Flooding along the Ouachita River, Bayou LaFourche, Chauvin Bayou, and Youngs Bayou in Monroe, Louisiana, and vicinity is described in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records. occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The highest flood of record on the Ouachita River at Monroe in May 1958 with a stage of 50.45 feet (elevation 81.85). The greatest recorded flood on the Bayou LaFourche was in April 1947 with a stage of 28.7 feet (elevation 65.8) at Crew Lake, Louisiana. The Intermediate Regional Flood would be about 4 feet higher than the maximum flood at Monroe. (Woodard-USGS) W71-09338

SPECIAL FLOOD HAZARD INFORMATION REPORT ON ECONLOCKHATCHEE RIVER, ORANGE AND SEMINOLE COUNTIES, FLORIDA.

Corps of Engineers, Jacksonville, Fla.

Corps of Engineers Flood Plain Report, June 1970. 3 p, 21 fig, 1 map.

Descriptors: \*Floods, \*Flood damage, \*Florida, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.

Identifiers: Orange County (Fla), Seminole County (Fla), Standard Project Flood, Intermediate Regional Flood.

Flooding of the Econlackhatchee River, Orange and Seminole Counties, Florida, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occured and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. The U.S. Geological Survey has maintained a stream gage on Econlockhatchee River at the State Highway 13 bridge near Chulota since 1935. The highest stage recorded at this gage was 20.8 feet during the March 1960 flood. The maximum discharge of record, 11,000 cfs, occurred during that same flood, which has an estimated frequency of once in 30 years. (Woodard-USGS) W71-09339

FLOOD PLAIN INFORMATION, VERMILION RIVER, SKELLENGER CREEK, AND BONNEY CREEK, OHIO.

Corps of Engineers, Buffalo, N. Y.

Army Corps of Engineers Flood Plain Report, May 1970. 18 p, 16 fig, 14 plate, 3 tab.

Descriptors: \*Floods, \*Flood damage, \*Ohio, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood. Identifiers: Vermilion River (Ohio), Standard project flood, Intermediate regional flood.

Flooding of the Vermilion River, Ohio is described Flooding of the Vermilion River, Onto is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. During the 1969 flood the river reached its highest level, dating back to the early 1900's. The Vermilion Lagoons area, located on the right bank and extending from the mouth upstream to Liberty Avenue, suffered the greatest damage. The storm began at about 7:00 p.m. on Friday (July 4) and at 1:00 a.m. on Sunday the gage at North Ridge Road recorded a peak of 17.1 feet, at North Ridge Road recorded a peak of 17.1 feet, the maximum stage of record, and about 15 feet above normal for that time. (Woodard-USGS) W71-09340

LEGAL ASPECTS OF WATER USE AND CONTROL IN SOUTH CAROLINA. PART A - LEGAL CONSIDERATIONS RELATING TO A WATER RESOURCES LAW FOR SOUTH CAROLINA,

Clemson Univ., S.C. Water Resources Research

For primary bibliographic entry see Field 06E.

LEGAL ASPECTS OF WATER USE AND CONTROL IN SOUTH CAROLINA. PART B - - SOUTH CAROLINA LAKES AND PONDS: A STUDY OF PUBLIC AND PRIVATE RIGHTS THEREIN, Clemson Univ., S.C. Water Resources Research

For primary bibliographic entry see Field 06E. W71-09364

#### A FLOOD INSURANCE MODEL FOR SHARING THE COSTS OF FLOOD PROTECTION,

Central Connecticut State Coll., New Britain. Dept. of Economics.

James C. Loughlin.

Water Resources Research, Vol. 7, No. 2, 3 tables, 1 figure, 12 references, p. 236-244 April 1971.

Descriptors: \*Flood plain insurance, \*Costs, \*Nonstructural alternatives.

Identifiers: \*1968 Flood Control Act, Flood Insurance Act.

The author states that there is an over reliance on structural measures and insufficient considerations of nonstructural measures (zoning, land use, warnings, flood insurance, etc.). A flood insurance program alerts the potential occupant of the risk he faces. Both types of measures, at a least cost combination, should be used. With the passage of the National Flood Insurance Program in 1968, there was an increase in the financial liability of the residents. It is a new way of finding optimal use of the flood plain. (Campbell-Rutgers)
W71-09402

#### 4B. Groundwater Management

IDENTIFICATION OF IRRIGATION RETURN WATER IN THE SUB-SURFACE, PHASE III: KAHUKU, OAHU AND KAHULUI AND LAHAINA, MAUI, Hawaii Univ., Honolulu. Water Resources

Research Center.

#### Watershed Protection—Group 4D

For primary bibliographic entry see Field 05B.

GEOLOGY AND GROUNDWATER RESOURCES OF TRAILL COUNTY: PART 3 GROUNDWATER RESOURCES,

Geological Survey, Bismark, N. Dak. For primary bibliographic entry see Field 02F. **W7**1-09090

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY: APPENDIX D - GEOLO-GY AND GROUND WATER (FINAL DRAFT), Geological Survey, Arlington, Va. and Geological Survey, Hartford, Conn.

For primary bibliographic entry see Field 03B. W71-09106

A LONG-RANGE FORECAST OF WATER FLOW TO LARGE LAKES OF THE LADOGA BASIN (RUSSIAN: DOLGOSROCHNYY PROGNOZ PRITOKA VODY V KRUPNYYE OZERA LADOZHSKOGO BASSEYNA),

LADOZHSKOGO BASSETMA),

1. B. Lyapunova.

In: Problems in Hydrological Forecasting (Voprosy gidrologicheskikh prognozov), Gosudarstvennyy Ordena Trudovogo Znameni Gidrologicheskiy Institut Trudy, No 179; Gidrometeoizdat, Leningrad, p 99-116, 1970. 18 p, 6 fig, 3 tab, 6 ref.

Descriptors: \*Forecasting, \*Flow, \*Lakes, \*Climatic data, Air circulation, Navigation, Runoff, Precipitation (Atmospheric), Atmospheric pres-

Identifiers: \*USSR, Lake Ladoga.

A method of forecasting total flow of water to large lakes of the Ladoga basin from December of one year through October of the next is based on a rela-tionship between anomalies of flow and anomalies of atmospheric circulation and on development of of atmospheric circulation and on development of atmospheric circulation processes during the for-mation of flow and the preceding period (May-Oc-tober of the first year). The reliability of the rela-tionship, which makes it possible to predict a given flow one year in advance, is 0.88. The results of using a prognostic relationship of total annual flow to antecedent atmospheric circulation are satisfactory for developing long-range forecasts of minimum navigational levels for Lake Ladoga. (Josefson-USGS)
W71-09129

GOUNDWATERS OF THE MANGYSHLAK-UST URT OIL-AND GAS-BEARING REGION (RUS-SIAN: PODZEMNYYE VODY MANGYSHLAK-USTYURTSKOY NEFTEGAZONOSNOY PROVINTSII),

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogologii i Gidrofiziki.

Zh. S. Sydykov, B. Kukabayev, A. K. Kugeshev, A. S. Vishnyakov, and G. V. Kulikov.
Alma-Ata, USSR, 'Nauka' Publishing House, 1970.
202 p, 26 fig, 45 tab, 145 ref.

Descriptors: \*Groundwater, \*Water types, \*Geologic investigations, \*Water yield, \*Aquifers, Water properties, Deserts, Geologic time, Geologic formations, Topography, Hydrogeology, Climatic data, Stratigraphy, Water supply, Brackish water, Fresh water, Thermal water, Mineral water, Groundwater recharge, Groundwater mining. Identifiers: \*USSR, \*Kazakhstan, Mangyshlak Peninsula, Ust Urt Plateau, Zonality, Mineralization Balneology.

tion, Balneology.

The formation and distribution of groundwater in the vast desert regions of the Manygyshlak Penin-sula and Ust Urt Plateau are examined with particular reference to depths of groundwater occur-rence, groundwater yields and groundwater hydrodynamic, hydrochemical and hydrothermal conditions. Large natural resources of fresh and brackish groundwater can be found in the aquifers of the region, particularly in Permian-Triassic, Lower Cretaceous, Miocene deposits and in sandy

massifs. Fresh waters can be effectively used for domestic consumption and for serving industrial projects in Southern Mangyshlak; brackish waters can be used for flooding pasture lands and for meeting domestic and industrial needs and, in some instances, for oasis irrigation. Extensive use can be made of mineral and thermal waters of the region, for example, for balneotherapy and for supply of heat. (Josefson-USGS)

W71-09135

A PRELIMINARY EVALUATION OF BANK STORAGE ASSOCIATED WITH LIBBY RESERVOIR IN NORTHWESTERN MONTANA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 03B. W71-09137

GROUNDWATER DATA AS OF 1967--COLORADO DESERT SUBREGION, CALIFOR-

Geological Survey, Menlo Park, Calif. Water Resources Div

For primary bibliographic entry see Field 07C. W71-09142

SUMMARY OF THE GROUNDWATER DATA AS OF 1967--CALIFORNIA REGION,
Geological Survey, Menlo Park, Calif. Water

Resources Div. For primary bibliographic entry see Field 02F. W71-09143

GROUNDWATER DATA AS OF 1967--NORTH COASTAL SUBREGION, CALIFORNIA, Geological Survey, Menlo, Calif. Water Resources

For primary bibliographic entry see Field 07C.

GROUNDWATER DATA AS OF 1967--SOUTH LAHONTAN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 07C. W71-09145

GROUNDWATER DATA AS OF 1967--NORTH LAHONTAN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 07C. W71-09146

GROUNDWATER DATA AS OF 1967--SAN JOAQUIN BASIN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 07C. W71-09147

GROUNDWATER DATA AS OF 1967--SACRA-MENTO BASIN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C. W71-09148

OBSERVATIONS ON WATER CONTENT CHANGES IN STRATIFIED SEDIMENTS DUR-ING PIT RECHARGE, Arizona Water Resources Research Center, Tuc-

Ground Water, Vol 9, No 3, p 29-40, May-June 1971. 11 p, 7 fig, 23 ref.

Descriptors: \*Pit recharge, \*Artifical recharge, \*Unsaturated flow, \*Water reuse, \*Water level fluctuations, Hydrogeology, Hydrographs, Infiltration, Percolation, Water table, Water levels, Alluvium, Porous media, Soil water movement, Groundwater recharge. Identifiers: Recharge testing.

Two pit recharge tests were conducted at an instrumented research site near Tucson, Arizona using cooling tower blowdown effluent from a nearby power plant. The first trial in 1966 consisted of 142 days of continuous inundation. The second test in 1968, comprised 15 wet-dry cycles with a total inundation time of 80 days. Qualities recharged by the two management techniques were contrasted. Water content profiles in 14 access wells clearly delineated two principal recharge mounds built above the water table within stratified materials in the 80 ft deep zone of aeration. During the continuous inundation test three stages were apparent in the history of the recharge mounds: growth stage, equilibrium stage and drainage stage. It was possible to relate these various stages to intake characteristics of the pit. (Knapp-USGS)
W71-09301

#### 4C. Effects on Water of Man's Non-Water Activities

FOREST CUTTINGS RAISE TEMPERATURES OF SMALL STREAMS IN THE SOUTHERN AP-PALACHIANS,

Southeastern Forest Experiment Station, Franklin,

N.C. Coweeta Hydrologic Lab. Lloyd W. Swift, Jr., and James B. Messer. Journal of Soil and Water Conservation, Vol 26, No 3, p 111-116, May-June 1971. 6 p, 2 fig, 2 tab, 22 ref.

Descriptors: Clear-cutting, \*Water temperature, \*Runoff, Small watersheds, Water conservation, Water quality, Vegatation effects, Thermal pollution, Fish, Trout, Water pollution sources. Identifiers: Stream water temperatures.

Stream temperatures were measured during six forest-cutting treatments on small (23- to 70-acre) watersheds in the sourthern Appalachian Mountains. Where forest trees and all understory vegetation were completely cut maximum stream temperatures in summer increased from the normal 66 deg F to 73 deg or more. Some extreme treatments raised temperatures more than 12 deg above normal. Where steambank vegetation was uncut or had regrown, summer maximums remained unchanged or declined from temperatures measured under uncut mature hardwood forest. Increases in stream temperature were judged to degrade water quality and constitute thermal pollution because, after each clearcut, water temperatures exceeded optimum levels for trout habitat. (Knapp-USGS) W71-09274

POLLUTION PROBLEMS IN THE PATCH',

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05B.

PRELIMINARY EVALUATION OF HYDROLOGIC EFFECTS OF IMPLEMENTING
WATER AND SEWERAGE PLANS, DADE
COUNTY, FLORIDA,
Geological Survey, Miami, Fla.

For primary bibliographic entry see Field 06D. W71-09334

#### 4D. Watershed Protection

SIMULATION OF WATER YIELD FROM DEVEGETATED BASINS, Hydrocomp International, Palo Alto, Calif.

For primary bibliographic entry see Field 03B. W71-09001

# Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

### **Group 4D—Watershed Protection**

SEEPAGE EFFECT ON CHANNEL BANK STA-

BILITY, Bureau of Reclamation, Denver, Colo. Hydraulics Machinery Branch; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 04A. W71-09110

TALL WHEATGRASS BARRIERS FOR SOIL EROSION CONTROL AND WATER CONSER-VATION,

VATION,
Agricultural Research Service, Sidney, Mont. Soil
and Water Conservation Research Div.
A. L. Black, and F. H. Siddoway.
Journal of Soil and Water Conservation, Vol 26,

No 3, p 107-111, May-June 1971. 5 p, 4 fig, 3 tab, 7

Descriptors: \*Erosion control, \*Water conserva-tion, \*Windbreaks, \*Wheatgrss, \*Snow manage-ment, Water storage, Wind erosion, Shelterbelts, Soil conservation, Cover crops, Sediment control. Identifiers: \*Wind erosion control.

A perennial grass barrier system of conservation farming was evaluated for soil-water conservation and soil erosion control. Each barrier consisted of two rows of tall wheatgrass (Agropyron elongatum) seeded in 36-inch rows. Barriers were spaced 30 to 60 feet apart. By trapping snow, the continuous crop sequence with barriers stored 86 to 116% as much water as crop-fallow without barriers. At a height of 12 inches, windspeed from leeward of one barrier to windward of the next barrier increased from 17 to 70% of open field windspeed in the 30-foot barrier spacing and from 19 to 84% in the 60-foot interval. (Knapp-USGS) W71-09276

#### **05. WATER QUALITY** MANAGEMENT AND **PROTECTION**

#### 5A. Identification of Pollutants

TOXICITY OF SEA WATER TO COLIFORM **BACTERIA** 

Metcalf and Eddy, Boston, Mass. Hugh P. Savage, and Bruce N. Hanes.

Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 854-861. 16 fig, 1 tab, 16

Descriptors: \*Coliform, \*Bioindicators, Saline water, \*Toxicity, Light intensity, Temperature, Bacteriophages, Sedimentation, Adsorption, Biochemical oxygen demand, Nutrients, Bacteria, Sampling, Analytical techniques, Water quality control, \*Pollutant identification, Water pollution

Identifiers: \*Bacterial density, Predators.

Investigations were conducted to establish whether or not the presence of coliform organisms in sea water provides a direct indication of recent fecal contamination. Samples taken in the ocean several miles offshore have been consistently devoid of coliforms, seemingly indicating that sea water has a toxic effect on coliforms. Samples of sea water were taken from an area relatively devoid of direct fecal contamination and mixed with raw sewage to yield desired BOD to volume ratios. BOD levels in flasks in conditions A, B, and C. were 0.6 to 1.8 mg/l, 9.9 to 20 mg/l, and 101 to 120 mg/l respectively. The conclusions obtained from this series of tests included: (1) somewhere between 1 and 10 mg/l BOD, fresh seawater temporarily loses its toxicity to total and fecal coliform bacteria; (2) in fresh seawater with BOD levels of 10 to 120 mg/l, a linear relationship seems to exist between the log of the maximum bacterial densities and the initial BOD; (3) the percentage of both fecal and total coliform bacteria contributing to the total population increased as maximum density was approached and declined as the populations declined;

and (4) by themselves, total and fecal coliform bacteria are not reliable indicators of the degree of recent fecal pollution in seawater since, given suffi-cient nutrient levels, the bacterial density will increase. (Lowry-Texas) W71-08946

ANALYSIS OF WATER FOR MOLECULAR HYDROGEN CYANIDE,
North American Rockwell Corp., Athens, Ga. Rocketdyne Div.
K. H. Nelson, and I. Lysyj.
Journal Water Pollution Control Federation, Vol
43, No 5, May 1971, p 799-805. 4 fig, 2 tab, 8 ref.
FWPCA Contact No 14-12-491.

Descriptors: \*Toxicity, \*Chemical wastes, Waste water (Pollution), Aquatic environments, Analytical techniques, Instrumentation, Water analysis, Gas chromatography, Polarographic analysis, Calibrations, Electric currents, Cathodes, Anodes, Temperature, Hydrogen ion concentration, Water quality, Pollutant identification. Identifiers: \*Hydrogen cyanide.

An analytical technique to measure concentrations of molecular hydrogen cyanide at levels of less than 100 parts per billion has been developed. The method used combines vapor phase equilibrium techniques with highly sensitive amperometric techniques to measure sparged HCN with a rotating gold anode by measuring current output of the system. Calibration of the system was accom-plished using synthetic solutions of known composition. Synthetic unknowns were then tested, as well as fresh water from Sespe Creek in Ventura County, California. Synthetic samples of pH 6.1, 7-2, and 8.2 had standard deviations of 1.42, 2.59, and 3.12 respectively. The fresh creek water, to which known amounts of cyanides were added, had a pH of 8.2 and a standard deviation of 1.35. Current responses of a number of possible interferring ions were also measured. It was determined that H2S, in levels greater than the concentration level of HCN, could interfere with the readings. In concentrations below that of HCN, H2S was shown to have no effect on the readings. Present detection limits seemed to have been established by the techniques of handling and transferring nanogram quantities of the desired species. Therefore, improved handling techniques along should provide the prodecure with considerably more resolution. (Lowry-Texas) W71-08952

A SIMPLE METHOD FOR THE BIOLOGICAL ASSESSMENT OF THE EFFECTS OF WASTE DISCHARGES ON AQUATIC BOTTOM-DWELLING ORGANISMS,

Virginia Polytechnic Inst., Blacksburg, Va. John Cairns, Jr., and Kenneth L. Dickson. Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 755-772. 7 fig, 3 tab, 41 ref.

Descriptors: \*Statistical methods, \*Mathematical models, Ecosystems, Sampling, Biological proper-ties, Isolation, Analytical techniques, Microorgan-isms, Biological communities, Data processing, \*Pollutant identification, Water pollution effects. Identifiers: \*Sequential Comparison Redundancy expression, Confidence levels.

Biological methods of assessing pollutional damage are increasing in prominence with respect to physical and chemical methods. To facilitate the acceptance of biological monitoring, a complete program, including sampling, collection, isolation, preservation, identification, and data analysis, is presented. Sampling equipment includes multipleplate artificial substrate samplers, bottom basket type artificial substrate samplers, grab samplers, surber square foot samplers, dredges, and nets. Data evaluation includes a comparison of species counted by both a biologist and a non-biologist, indicating that most bottom fauna organisms are fairly easily dividable into recognizable entities by non biologists. The Sequential Comparison Index

(SCI) is introduced as a simplified method for estimating relative differences in biological diversity.

The SCI is a rapid technique based on differences in shape, color, and size of the organisms collected. Confidence levels are established using a diversity index value obtained from collecting point data. This technique involves too much mathematical manipulation to be widely applied, but a computer program is also presented which will compute the diversity per individual, d, and the redundance expression, r. (Lowry-Texas) W71-08954

CHEMICAL CHARACTERISTICS OF PRECIPITATION IN THE CHAMPLAIN VAL-

Vermont Univ., Burlington. Dept. of Zoology. For primary bibliographic entry see Field 02K. W71-08973

CYCLE OF ORGANIC MATTER IN THE SEA, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05C.

LOW AMBIENT LEVEL UPTAKE OF 14C-DDT BY THREE SPECIES OF MARINE PHYTOPLANKTON, Stanford Univ., Pacific Grove, Calif. Hopkins

Marine Station.

James L. Cox.

Bulletin of Environmental Contamination and Toxicology, Vol. 5, No. 3, p 218-221, 1970. 1 tab, 11 ref. NSF Grant No. 8408 and California Marine Research Commission, unspecified grant.

Descriptors: \*DDT, \*Pesticide residues, \*Absorp-Descriptors: \*DD1, \*Pesticide residues, \*Aosorption, \*Phytoplankton, \*Analytical techniques, Chlorinated hydrocarbon pesticides, Pesticide kinetics, Bioassay, Laboratory tests, Pollutant identification, Water pollution sources.

Identifiers: Accumulation, Concentration,

Syracosphaera sp., Thalassiosira sp., Amphidinium

Because it was deemed desirable to determine partition coefficients of organisms for DDT residues at concentrations similar to those in the marine environment, an attempt was made to measure carbon-14-DDT uptake for three species of marine phytoplankton in pure culture. At equilibrium, 16-54% of the initially added C-14-DDT was removed from the water by the algal cells. True partition coefficients calculated using known volume percentages for the algal clones used in these experiments are 2.5 x 104 for Syracosphaera carterae and for Thalassiosira fluviatilus, and 8.0 x 104 for Amphidinium carteri. These values are equivalent to wet weight concentration factors. Washington)
W71-09035 (LeGore-

AERIAL PHOTOGRAPHY OF OIL SLICKS,

Field Studies Council, Pembroke (England). Oil Pollution Research Unit.

Roger Worsley.
Field Studies Council, Oil Pollution Research Unit, Orielton Field Centre, Annual Report, 1969, p 48-

Descriptors: \*Oil, \*Oily water, \*Remote sensing, \*Aerial photography, \*Warning systems, Oil wastes, Water pollution sources, Pollutant identification, Pollution abatement.

Identifiers: \*Oil pollution, \*Oil spills, \*Detection of pollution, Infra-red photography.

Infra-red color photography was investigated as a potential tool for early detection of marine oil spills. Details of techniques used are provided. The author concludes that the techniques are not suitable for routine use, which would entail specially loaded cameras on all existing air services, applicability in only bright supliest, and use of critically bility in only bright sunlight, and use of critically important exposures and processing. Similarly,

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants—Group 5A

polarization photography, though easier, is unsuitable because the need for the aircraft to circle would require substantial deviations from planned flight paths. Either method, however, would be useful in emergency situations. (LeGore-Washington) W71-09046

# IDENTIFICATION OF MS-222 RESIDUES IN SELECTED FISH TISSUES BY THIN LAYER CHROMATOGRAPHY, Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeastern Fish Control Lab.

John L. Allen, Charles W. Luhning, and Paul D. Harman.

U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Investigation in Fish Control Series, No 41, 1970. 7 p, 3 tab, 3 ref.

Descriptors: \*Analytical techniques, \*Bioassay, \*Color reactions, Fish \*Chromatography, \*Color reactions, Fish physiology, Colorimetry, Laboratory tests, Path of pollutants, Fish control agents, Fish farming, Fish handling facilities, Fish management, \*Pollutant

Identifiers: MS-222, \*Anesthetics, Fish anesthetics, Drugs, Thin-layer chromatography.

MS-222 (methanesulfonate of meta-aminobenzoic acid ethyl ester) a commonly used fish anesthetic, reacts with the Bratton-Marshall reagents to form a wine-red dye. Residues of MS-222 determined by this reaction are not distinguished from other primary aromatic amines. Thin layer chromatography was used to identify MS-222 in the presence of background primary aromatic amine in fish muscle, brain and blood. This method, in which the Bratton-Marshall reaction is used to visualize the spots, gave both the specificity of the Bratton-Marshall reaction for primary aromatic amines and the Rf of MS-222 as tools for identification of the residues. Since the meta-aminobenzoate ester can be identified this should be a useful ancillary or confirmatory method for determining the rate of disappearance of drug residues in fish flesh and obtaining data for clearance and registration of the anesthetic with the Food and Drug Administration. (LeGore-Washington)
W71-09048

# PERSISTENT PESTICIDES IN THE ENVIRON-

Rothamsted Experimental Station, Harpenden (England).

For primary bibliographic entry see Field 05B. W71-09088

#### RESIDUES OF TOTAL MERCURY METHYLMERCURIC SALTS IN LAKE TROUT

AS A FUNCTION OF AGE, Cornell Univ., Ithaca, N.Y. Pesticide Residue Lab. For primary bibliographic entry see Field 05C.

# MULTIPLE CORER FOR SAMPLING

PROFUNDAL BENTHOS,
Fisheries Research Board of Canada, Winnipeg

(Manitoba). Freshwater Inst. Andrew L. Hamilton, William Burton, and John F.

Flannagan. Journal Fisheries Research Board of Canada, Vol 27, No 10, p 1867-1869, 1970. 2 fig, 3 ref.

Descriptors: \*Sampling, \*Profundal zone, \*Benthos, Cores, Invertebrates, Stratigraphy, Sedi-Descriptors:

Identifiers: \*Multiple corer, Chironomid.

In interpreting the results of earlier studies of the macroinvertebrates that live in lake sediments, the efficiencies of the samplers used have not been evaluated. Since recent efforts in aquatic biology have been directed toward such basic problems as production and community energetics, the need for quantitative, or at least semiquantitative samplers, has developed. A multiple corer for sampling the

benthos of profundal sediments is described. It is relatively simple to construct and is light (approximately 17.5 lb (7.9 kg)) and easy to use. Since the area to be sampled is very small, several samples are needed. This corer is designed to take four core samples simultaneously, thus compensating for the small size of the individual core tubes. The samples from each core can, depending on circumstances, be analyzed separately or lumped together in a sin-gle sample. The sampler is well suited for use in small boats lacking power equipment. Trials re-ported elsewhere indicate that in soft sediments the samples taken are generally superior to those col-lected with most, if not all, of the more conven-tional samplers tested. (Jones-Wisconsin) W71-09158

#### APPLICATION OF ASSOCIATION-ANALYSIS TO DISTRIBUTION STUDIES OF RECENT FORAMINIFERA,

Bedford Inst. Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.

G. Vilks, E. H. Anthony, and W. T. Williams.
Canadian Journal of Earth Sciences, Vol 7, No 6, p 1462-1469, 1970. 4 fig, 3 tab, 6 ref.

Descriptors: \*Analytical techniques, \*Bioassay, \*Marine microorganisms, Distribution, Environ-mental gradient, Animal groupings, Benthos, Ecological distribution, Ecosystems, Statistical methods.

Identifiers: \*Foraminifera, \*Association analysis, Canadian Arctic, Multivariate method, Marine

Important factors underlying an ecosystem may be revealed objectively through suitable analysis of interspecific associations of its biota. This objective assessment is valuable in surveys of remote areas such as marine benthos where visual examination is difficult if not impossible. Foraminifera are used for this analysis because of their ubiquitous distribution, large population, and large numbers of species readily identified. Counts of species from 75 samples of sediment from East Bay, Mackenzie King Island, in the Canadian Arctic were converted to a matrix of presence-absence data (56 species X 75 stations). These were submitted to both normal and inverse association-analysis as a preliminary test of the application of that multivariate method to problems in marine ecology. Results are compared with observations made at the time the survey was carried out. Although the pattern of sampling was not the most suitable for association-analysis, the results indicate that this analysis holds some promise of informative revelations about the Foraminifera environment. In experimental approaches to understand problems of marine ecology, the inverse form of association analysis may in-dicate groups of organisms particularly useful for comparative physiological ecology. (Jones-W71-09177

#### A COMPUTER BASED FLORISTIC ANALYSIS OF PAMLICO RIVER PHYTOPLANKTON,

East Carolina Univ., Greenville, N.C. Dept. of Biology.

Vincent J. Bellis.

Available from North Carolina Water Resources Research Institute, Raleigh, North Carolina 27607 - Price: \$2.50. Available from National Technical Information Service as PB-200 262, \$0.95 in microfiche. Report No 46, UNC-WRRI, North Carolina State University at Raleigh, Jan 1971. 28 p, 7 fig, 5 tab, 13 ref. OWRR Project A-044-NC (1).

Descriptors: \*Phytoplankton, \*Plant groupings, Computer programs, Numerical analysis, \*Aquatic life, \*Data processing, North Carolina. ldentifiers: \*Pamlico River.

A computer based technique for analyzing distribution patterns among estuarine organisms was developed and tested on phytoplankton collections from Pamlico River. Jaccard's coefficient of

similarity was used to generate a similarity matrix with final printout in dendrogram form showing clusters of collections having inherent similarity.
Use of a similarity index based solely upon presence or absence of species within all possible pairs of collections (raw data) produced a dendrogram which described the seasonal periodicity of phytoplankton in the central Pamlico River. Computer programs developed in this project are written in Fortran IV and have been deposited in the program library of the East Carolina University Computer Center and can be obtained upon request from its director. (Howells-North Carolina) W71-09211

#### MIGRATION AND METABOLISM IN A STREAM ECOSYSTEM,

North Carolina Univ., Chapel Hill. Dept. of Zoology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.

Charles A. S. Hall.

Available from UNC-WRRI, North Carolina State University, Raleigh, North Carolina, 27607 - Price: \$2.50. Available from the National Technical In-\$2.50. Available from the National Technical Information Service as PB-200 264, \$0.95 in microfiche. Report No 49, WRRI, The University of North Carolina, Feb 1971. 243 p, 52 fig, 33 tab, 120 ref, append. OWRR Project B-007-NC (3).

Descriptors: \*Ecosystems, Aquatic environment, Aquatic habitat, Limnology, \*Fish migration, \*Standards, \*Sampling, Water analysis, Migration, \*Metabolism, North Carolina, Monitoring, Dissolved oxygen, Water quality, Productivity. Identifiers: \*Stream surveys, \*Stream classification, New Hope Creek (N.C.).

Fish migration and total stream metabolism were monitored in New Hope Creek, N.C., from April, 1968 to June, 1970. Most of the 27 species had a consistent pattern of larger fish moving upstream and smaller fish moving downstream. In the spring of 1969, a daily average of 7 fish weighing a total of 1081 grams were caught moving upstream, and 17 fish, weighing a total of 472 grams, were caught moving downstream. The larger average size of the fish moving upstream resulted in a large transfer of fish mass upstream. Diurnal oxygen series were run to measure the metabolism of the aquatic community. Gross photosynthesis ranged from 0.21 to almost 9 g m-2 day-1 (g/m2/day), and community respiration from 0.4 to 13 g m-2 day-1 at the principal sampling station and both were highest in the spring. Area values of metabolism were similar for different parts of the stream, but both production per volume and respiration per volume were much larger near the headwaters than farther downstream. Migration may allow populations to take advantage of such differences in productivity by maintaining young fish in areas of high produc-tivity. An energy diagram was drawn comparing energies of insolation, currents, photosynthesis, respiration, fish populations, and migrations. Parts of this model were simulated on an analog computer. Input energies from insolation and stream flow were similar. About 0.14 percent of the total respiration of the stream was from fish populations, and over one year about 0.01 percent of the total energy was used for the process of migration. The migration energy has an amplifying value of 14. Recommendations are included concerning sampling for dissolved oxygen and other aspects of water quality management. W71-09213

#### **RADIATION SURVEILLANCE - MONITORING** THE ENVIRONS OF A NUCLEAR STATION,

Iowa-Illinois Gas and Electric Co. L. C. Oyen.

Mechanical Engineering, Vol 92, No 8, p 32-37, Aug 1970.

\*Radioisotopes, \*Absorption. Descriptors: \*Nuclear wastes, \*Radioactive wastes, Food chains, Surface waters, Groundwater, Groundwater movement, Air pollution effects, Water pol-

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5A—Identification of Pollutants

lution effects, Strontium radioisotopes, Iodine radioisotopes, Fish, Milk, Mississippi River, Sediments, Water pollution sources. Identifiers: Cesium radioisotopes.

The Quad-cities Nuclear Plant has a monitoring program that may serve as a prototype. Air, water, rogram that may serve as a prototype. Air, water, vegetain, soil, and key foods such as fish and milk will be surveyed periodically both off- and on-site in accordance with 'Federal Standards for Protection against Radiation.' Water and sediment at the plant intake and discharge canals to the Mississippi River is sampled continuously. Drinking water from on-site wells and from the four closest off-site wells, and Mississippi River water at the intake of downstream communities is sampled periodically. (Bopp-ORNL) W71-09249

## THE DEVELOPMENT OF A WIDE RANGE IMAGE SPECTRO PHOTOMETER INFORMA-TION SYSTEM,

TRW Systems Group Redondo Beach, Calif. For primary bibliographic entry see Field 07B.

## THE STUDY OF THE PHYSICAL, CHEMICAL AND BIOLOGICAL NATURE OF WATER QUALITY UNDER UTAH CONDITIONS,

Utah State Univ., Logan. John M. Neuhold.

Available from the National Technical Information Service as PB-200 621, \$3.00 in paper copy, \$0.95 in microfiche. Utah State University Project Completion Report, June 1971. 57 p, 19 fig, 10 tab, 13 ref, append. OWRR Project A-003-Utah (14).

Descriptors: \*Tertiary treatment, \*Water pollution control, \*Bibliographies, \*Abstracts, \*Municipal wastes, Water quality, Utah, Aquatic habitats, Bioindicators, Environment, Ecology, Fish, Dissolved oxygen, Sewage treatment. Identifiers: \*Logan River (Utah).

Domestic sewage effluent into a high mountain valley stream can produce a complexity of effects on receiving waters. Mountain streams are cold waters which have envolved a diverse biological system adapted to cold temperature, clear water and in which sewage effluents can persist for relatively long periods of time. The lower Logan River below the City of Logan is such a stream. It receives domestic effluent from the City of Logan, which at the start of the study went directly, untreated, into the Logan River, and during the course of the study was diverted through an extensive primary-secondary-tertiary treatment lagoon system returning treated water back to the receiving stream. The physical, chemical and biological qualities of the Logan River were studied before and after treatment. The development of a biological system and its effect on the physical and chemical qualities in the lagoon system, built essentially upon a primordial substrate, were also studied. An annotated bibliography of 250 references on waste water stabilization ponds is included. Tertiary treatment ponds can be ecologically managed to minimize organic build-up. Design criteria should also be established to maximize retention time to fully utilize the ecosystem developed in the pond. Freeform designs are suggested as a possible means to accomplish this with the added benefit of improving aesthetics of the system. (Knapp-USGS) W71-09268

# POLLUTION OF A MARINA AREA BY WATERCRAFT USE AS INDICATED BY COLIFORM AND CHEMICAL CONCENTRA-TIONS,

Michigan State Univ., East Lansing. Dept. of Microbiology; and Michigan State Univ., East Lansing. Inst. of Water Research. For primary bibliographic entry see Field 05B.

W71-09270

FOREST CUTTINGS RAISE TEMPERATURES OF SMALL STREAMS IN THE SOUTHERN AP-

Southeastern Forest Experiment Station, Franklin,

N.C. Coweeta Hydrologic Lab. For primary bibliographic entry see Field 04C.

WATER ANALYSIS. Geological Survey, Denver, Colo. M. J. Fishman, and D. E. Erdmann. Analytical Chemistry, Vol 43, No 5, p 356-388, April 1971. 33 p, 631 ref.

Descriptors: \*Reviews, \*Bibliographies, \*Water analysis, \*Chemical analysis, Solutes, Ions, Pesticides, Dissolved oxygen, Detergents, Organic matter, Radioisotopes, Stable isotopes, Trace ele-

Identifiers: Dissolved gases.

This review of the literature of analytical chemistry applied to water analysis covers a period from October 1968 through September 1970. The review includes a list of other reviews made in the period covered. Water analysis is subdivided into classes of constituents analyzed, and includes pesticides, oxygen, gases, detergents, organics, radioisotopes, stable isotopes, heavy metals, and mercury, as well as common and trace ionic solutes. A bibliography of 631 entries is divided into the same classes as the text. (Knapp-USGS) W71-09289

# MERCURY IN A COASTAL MARINE EN-

VIRONMENT, Southampton Univ. (England). J. D. Burton, and T. M. Leatherland. Supported by Natural Environment Research Council. Nature, Vol 231, No 5303, p 440-442, June 18, 1971. 3p, 1 tab, 14 ref.

Descriptors: \*Heavy metals, \*Pollutant identification, \*Poisons, \*Estuaries, \*Sea water, Path of pollutants, Water pollution sources, Bottom sedi-ments, Water chemistry, Water analysis, Water quality.

Identifiers: \*Mercury, \*English Southampton water.

Mercury enters the oceans at comparable rates as a result of both human activities and continental weathering. The oceanic residence time of mercury is about 10,000 yr, so that human activities cannot yet have had a significant influence on the amounts of the element in the marine environment considered on a wide scale, whatever the effects on restricted environments. Some initial findings of investigations carried out in Southampton Water and the English Channel are discussed with these considerations in mind. Mercury in natural waters was determined spectrophotometrically with dithizone, after preliminary concentration and separation. Mercury in organisms and sediments was determined by neutron activation analysis of freezedried material. River Water entering Southampton in the Rivers Test and Itchen contained 0.010 micrograms/liter less than that in the estuary and the open water of the English Channel. The concentrations in whole Mercenaria, without shell, ranged from 0.18 to 0.57 p.p.m. dry weight (0.03 to 0.12 p.p.m. wet weight). Three samples from the surface of the bottom mud in different parts of the estuary had mercury contents ranging from 0.19 to 0.64 p.p.m. Two samples of mud from underlying anoxic layers, at depths of about 10 cm, contained 2.2 and 5.7 p.p.m. showing that pronounced enhancement can occur in reducing conditions. (Knapp-USGS) W71-09293

ORIGIN OF PACIFIC OCEAN IRON-MAN-GANESE NODULES FROM RADIOISOTOPE DATA, (RUSSIAN: PROISKHOZHDENIYE ZHELEZO-MARGANTSEVYKH KONKRETSIY

PO DANNYM TIKHOGO RADIOIZOTOPAKH), Akademiya Nauk SSSR, Moscow. Geologicheskii

V. V. Cherdyntsev, N. B. Kadyrov, and N. V.

Geokhimiya No 3, p 339-354, Mar 1971. 16 p, 4 fig, 7 tab, 14 ref.

Descriptors: \*Inorganic compounds, \*Radioactive dating, \*Radiochemical analysis, \*Radioisotopes, Uranium radioisotopes, Histograms, Pumice, Mud, Diagenesis, Sea water, Geochemistry. Identifiers: \*USSR, \*Pacific Ocean, Nodules, Thorium radioisotopes, Protactinium, Plutonium, Ionium, Sea muds, Isotopic composition.

The content of U-234, U-238, Th-232, Io (Th-230), RdTh (Th-228), Pa-231 and Pu-239 in more than 100 samples of iron-manganese nodules of the Pacific is examined. The nodules reveal very large fluctuations in Th:U ratios, which usually correlate with the ratios of Io: U-238 and Pa: U-235. No genetic relationship can be seen between the nodules, underlying muds and pumice. The uranium content in the volcanogenic nuclei of nodules is 10 times that in basalts of the Pacific Isles. The extremely high Th:U ratio in several of the samples and very low lo: U and Pa:U ratios in other nodules seem convincing proof of the volcanogenic origin of their radioisotopes. (Josefson-USGS)

A MODULAR CONTROLLED-TEMPERATURE APPARATUS FOR FISH EGG INCUBATION AND FRY REARING, Federal Water Quality Administration, Duluth, Minn. National Water Quality Lab.
J. Howard McCormick, and Roll F. Syrett.
National Water Quality Laboratory, mimeographed report, Nov 1970. 18 p, 8 fig, 2 ref.

Descriptors: \*Bioassay, \*Toxicity, \*Laboratory equipment, \*Laboratory tests, Analytical techniques, Bioindicators, Pollutant identification, Water pollution effects, Facilities, Research facili-ties, Testing, Water quality, Juvenile fishes, Fry. Identifiers: \*Continuous-flow bioassay, Chronic pollution.

An apparatus is described for aquatic bioassay stu-dies. The apparatus described is constructed on a modular basis and provides continuous flow of water at constant temperatures for experimental work with fish eggs and fry. Each module provides one test temperature, which is controlled with a thermoregulator and immersion heater in each headbox. Flow is regulated by headbox elevation and orifice size. (LeGore-Washington) W71-09368

## AN ELECTRODE CHAMBER FOR RECORD-ING RESPIRATORY AND OTHER MOVE-MENTS OF FREE-SWIMMING ANIMALS,

Federal Water Quality Administration, Duluth, Minn; and Cincinnati Univ, Ohio, Dept. of Biological Science. For primary bibliographic entry see Field 05C. W71-09372

# CARBAMATE BIOASSAY USING DAPHNIA

MAGNA,
Cornell Univ., Ithaca, N.Y. Dept. of Entomology. Bruce L. Parker, James E. Dewey, and Carl A.

Journal of Economic Entomology, Vol 63, No 3, p 710-714, June 1970. 3 tab, 17 ref.

Descriptors: \*Carbamate pesticides, \*Insecticides, \*Bioindicators, \*Bioassay, \*Daphnia, \*Analytical techniques, \*Pollutant identification, \*Laboratory Test procedures, Pesticide residues, Pesticide toxicity, Public health, Water pollution ef-fects, Laboratory animals, Toxicity. Identifiers: \*Pesticide detection, Laboratory

procedures.

#### Sources of Pollution—Group 5B

A bioassay for detection and determination of minute quantities of carbamate insecticides in fruit and vegetable crops was developed with Daphnia magna. The Daphnia bioassay was quick, simple to prepare, reproducible, and proved more sensitive to carbamates than that for Drosophila melanogaster. Crops were treated in the laboratory and then extracted by a modification of the Niessen-Frehse method. The extracts of unknowns were sen-Frehse method. The extracts of unknowns were evaporated, reconstituted with dimethyl sulfoxide, and injected in 0.025 ml quantities into 13X100 mm test tubes containing 2.5 ml of water. D. magna specimens were introduced and toxicity observations were taken after 30 min. A standard curve was prepared daily in reagent grade solvents; check crop extractions were seldom necessary. Recoveries between 85-100% were consistently obtained. (LeGore-Washington) (LeGore-Washington) W71-09373

FISH-TOXICITY PROBLEMS OF PESTICIDES IN JAPAN - THE PRESENT SITUATION AND THE POLICIES OF THE MINISTRY OF AGRICULTURE AND FORESTRY, Agricultural Chemical Inspection Station, Tokyo

(Japan). Y. Hashimoto.

PANS, Vol 15, No 3, p 325-329, Sept 1969.

Descriptors: \*Bioassay, \*Water pollution control, \*Legislation, \*Permits, \*Polutant identification, \*Reviews, \*Agricultural chemicals, \*Pesticides, Governments, Water law, Bioindicators, Public health, Laboratory animals, Laboratory tests, Toxicity, Aquatic environment, Water pollution sources, Daphnia.

Identifiers: \*Japanese law, TL-m, Japan, Acute pollution, Chronic pollution.

An account is provided of the policy of the Ministry of Agriculture and Forestry of Japan toward hazards of pesticides to aquatic organisms. Requirements of the Agricultural Chemicals Control Law, which provides for pesticide registration, are outlined, and labelling requirements and a pesticide classification scheme are discussed. A 'standard' method for the evaluation of acute toxicity of agricultural chemicals to fish, and a tentative method for the evaluation of acute toxicity of pesticides to Daphnids are appended. (LeGore-Washington) W71-09377

AN ASSESSMENT OF THE ASSIMILATION OF ELEMENTAL PHOSPHOROUS BY NEWFOUN-DLAND MARINE ORGANISMS IN THE 1969 POLLUTION PROBLEM AND IN 1970 MONI-TORING OPERATIONS,

Fisheries Research Board of Canada, Halifax, (Nova Scotia). Halifax Lab.

R. G. Ackman, R. F. Addison, and J. Hingley. Technical Report No 208, 1970. 39 p, 3 fig, 18 tab,

Descriptors: \*Phosphorous, \*Absorption, \*Marine fish, \*Herrings, \*Mortality, \*Pollutant identification, \*Fish diseases, \*Fishkill, Inorganic compounds, Uptake (Biological), Chromatography, Water pollution effects, Water pollution, Path of pollutants, Toxins, Salmon, Smelts, Invertebrates, Crabs, Lobsters, Sculpins.

Identifiers: \*Assimilation, Gas-liquid chromatography, Flatfish.

Results obtained are presented from the analysis for elemental phosphorous of specimens of fish and of other marine organisms from Placentia Bay and Long Harbour, Newfoundland. The analysis was by gas-liquid chromatography. Dead herring from the kill in Placentia Bay in 1969 were found to contain up to 1200 ppb of elemental phosphorous in their tissures. In 1970, living herring were observed to contain up to 42 ppb of elemental phosphorous in their viscera. Up to 59.5 ppb of phosphorous were detected in the flesh of dead herring. (Katz-Washington) W71-09384

WATER, WATER EVERYWHERE, New York State Dept. of Environmental Conservation, Albany. Water Quality Surveillance Section. Ronald E. Maylath.

The Conservationist, Vol. 25, No. 5, p. 14-17, April - May 1971, 36, 3 figures.

Descriptors: \*Water quality control, \*Monitoring, \*Control systems, \*Automatic control. Identifiers: Mohawk River System.

This article describes the various components of the Water Quality Surveillance Network directed by the State of New York. Four primary types of surveillance are used in order to monitor New State's water quality conditions: manual, automatic, aerial and public. The author maintains that this network can avoid unnecessary expenditures of large sums of money to correct hazardous situa-tions which can be avoided if adequate surveillance is practiced. (Holmes-Rutgers) W71-09412

#### 5B. Sources of Pollution

IDENTIFICATION OF IRRIGATION RETURN WATER IN THE SUB-SURFACE, PHASE III: KAHUKU, OAHU AND KAHULUI AND LAHAINA, MAUI, Hawaii Univ., Honolulu. Water Resources

Research Center.

Pedro A. Tenorio, Reginald H. F. Young, Nathan C. Burbank, Jr., and L. Stephen Lau.

Service as PB-200 166, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report 44, Dec 1970. 53 p, 36 fig, 11 ref, append. OWRR Project B-013-HI (1). Available from the National Technical Information

Descriptors: \*Irrigation water, Groundwater, Nitrates, Dissolved solids, Hawaii, \*Return flow, Water pollution sources, \*Water reuse, Aquifers, Water quality, Pumping, Fertilization, Consump-

Identifiers: \*Irrigation return water.

The basal water quality of the Hawaiian Commercial and Sugar Company (HC and S) aquifer is most affected regionally, as well as locally, by the prevailing agricultural practices. The deterioration of the water is due in part to fertilization and to a greater extent to heavy pumping and recycling of the basal water. Water quality in the Pioneer Mill area parallels that of HC and S, although on a regional basis, the basal water quality, unlike that of the Pioneer Mill area, is not as deteriorated. Local effects of pumping are also especially noticeable in the Pioneer Mill area. Groundwater quality in the Kahuku area shows the obvious presence of irriga-tion return water indices, but, unlike the two plantations on Maui, the magnitude of the increases relative to uncontaminated water sources is considerably smaller. The effect of fertilization on Kahuku may be considered to be a principal factor in the regional distribution of index constituents with a relatively uniform nitrate distribution throughout. Local effects of pumping are quite pronounced and influence overall increases of indices, indicating that where heavy pumping takes place for irrigation, the increase in index constituents are correspondingly greater. W71-08972

# THE USE OF WATER AS A SAMPLING MEDI-UM FOR TRITIUM OXIDE,

Battelle-Northwest, Richland, Wash. Pacific Northwest Lab. D. McConnon.

Available from the National Technical Information Service as BNWL-CC547, \$3.00 in paper copy, \$0.95 in microfiche. Report BNWL-CC547, 1970.

Descriptors: \*Tritium, \*Oxides, \*Air, \*Pollutants, \*Sampling, Surfaces, Water pollution, Analytical techniques, Measurement, Indicators.

A sampling technique for airborne tritium oxide A sampling technique for airborne tritium oxide was developed and tested for 98 percent efficiency. The technique employs a gas wash bottle filled with ordinary distilled water through which air is bubbled at a constant flow rate. The method is rapid, reliable, and sensitive and has been proven under a variety of field conditions. Additionally, a technique is described for determining the amount of tritium oxide surface contamination. Because of of tritium oxide surface contamination. Because of difficulties in measuring the collection efficiency of the technique, it is presently used for qualitative measurements as a trend indicator. (Houser-NSIC) W71-09003

# MATHEMATICAL METHODS FOR EVALUATING THE TRANSPORT AND ACCUMULATION OF RADIONUCLIDES, Battelle Memorial Inst., Columbus, Ohio.

S. G. Bloom, A. A. Levin, W. E. Martin, and G. E.

Available from the National Technical Information Service as BMI-171-30, \$3.00 in paper copy, \$0.95 in microfiche. Report BMI-171-30, Apr 3, 1970. 40 p, 1 fig, 14 ref. Contract AT (26-1)-171.

Descriptors: \*Radioisotopes, \*Absorption, \*Food webs, \*Nuclear explosions, Ecosystems, Human population, Water pollution, Radioactivity effects, Mathematical models, Drainage systems, Water pollution sources, Atlantic Ocean, Pacific Ocean, Canals, Runoff, Fallout.

In this study, a series of models has been used to identify the most important radionuclides and other factors affecting the calculation of potential radiation doses to man. The major kinds of foodweb pathways are considered in an area large enough to include terrestrial, freshwater, and marine ecosystems; and to indicate the degree of ecological coupling between man and the environ-ment, including food and water. To be conserva-tive, a model is located within the watershed that has the highest fallout input and the lowest rate of radionuclide loss due to runoff; but the calculations for the aquatic compartments are based on the highest rate of runoff. For the marine ecosystem, the fallout input to seawater is maximized; the input from surface water is maximized; and the dilution due to dispersion and convection is minimized. Some differential equations for describing the biological transport are derived, and representative methods for obtaining the transfer coefficients are given. Analytical, finite-difference, and semianalytical methods for solving the differential equations are briefly described and a few methods are presented explicity with examples. (Sec also W71-09006) (Bopp-NSIC) W71-09008

#### RADIOECOLOGICAL STUDIES ON COLUMBIA RIVER. PART I,

Battelle Northwest, Richland, Wash. Pacific Northwest Lab.

D. G. Watson, C. E. Cushing, C. C. Coutant, and W. L. Templeton.

Available from the National Technical Information Service as BNWL-1377, \$3.00 in paper copy, \$0.95 in microfiche. Report BNWL-1377, June 9, 1970. 46 p.

Descriptors: \*Radioisotopes, \*Absorption, \*Biota, Zinc radioisotopes, Phosphorus radioisotopes, Runoff, Waste dilution, Water pollution control, Plankton, Periphyton, Scasonal, Radioecology, Water pollution sources.

The concentration of radionuclides which is found in natural waters and in biota is reduced by dilution from seasonal runoff. The increase in uptake by biota from the increase in metabolic activity in the spring is soon overwhelmed by runoff. Present data is similar to that collected prior to 1956 for beta, but not for gamma radiation levels. Shutdown of all reactors for seversl weeks dropped the level of most nuclides in the biota several orders of magnitude. The highest concentration factors were found in net plankton and periphyton for phosphorus-32 and zinc-65. (Bopp-NSIC)

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5B—Sources of Pollution**

w71-09017

PILGRIM NUCLEAR POWER STATION. PRELIMINARY SAFETY ANALYSIS REPORT, AMENDMENT 16. Boston Edison Co., Mass.

Available from the National Technical Information Service as DOCKET-50293-31, \$3.00 in paper copy, \$0.95 in microfice. Report DOCKET-50293-31, Oct 2, 1970. 189 p.

Descriptors: \*Water pollution control, \*Nuclear power plants, \*Potable water, \*Biota, Sampling, Marine fish, Marine animals, Marine algae, Tritium, Iodine radioisotopes, Strontium radioisotopes, Cobalt radioisotopes, Absorption, Water pollution sources.

Identifiers: Manganese radioisotopes, Cesium radioisotopes

radioisotones.

The surveillance program outside the station security fence includes the air, domestic and sea water, marine life, silt, milk, and crops. Water pumping stations which control water supply to most area residents are sampled and analyzed for gross beta and gamma biweekly, and for tritium and strontium monthly. Sea water intake and discharge canals are analyzed monthly for gross beta and gross gamma (with gamma spectrum analysis if the gross gamma increases), and tritium. Quarterly composites of the monthly samples are analyzed for manganese-54, zinc-65, cobalt-58, and cobalt-60. Fish, lobsters, and mollusks are samand cobalt-60. Fish, lobsters, and mollusks are sampled quarterly; Irish sea moss, during its harvest period. All marine life samples are taken from the vicinity of the discharge canal outfall and offshore current patterns and are analyzed for gross beta, gross gamma, strontium-90, cesium-137, manganese-54, cobalt-58, cobalt-60, zinc-65, and iodine-131. Equipment failures are analyzed with respect to release of radionuclides to the environment. (Bopp-NSIC) W71-09018

# FINAL REPORT OF OFF-SITE SURVEIL-LANCE FOR THE MILROW EVENT, OC-TOBER 2, 1969.

Southwestern Radiological Health Lab. Las Vegas,

Available from the National Technical Information Service as SWRHL-95r, \$3.00 in paper copy, \$0.95 in microfiche. Report SWRHL-95r, June 1970, 22 p, 1 fig, 4 tab.

Descriptors: \*Explosions, \*Excavation, \*Pollutants, \*Water pollution control, \*Water pollution sources, Envrionment, Environmental effects, Environmental engineering, Soil structure, Porosity, Porous media, Population, Geology, Alaska.

Amchitka Island, a member of the Aleutian Islands, was first used for an underground nuclear test in October 29, 1965. A second underground test, called the Milrow Event, was conducted by the Atomic Energy Commission at Amchitka on October 2, 1969. This report presents the operational procedures and results of the Public Health Service, Southwestern Radiological Health Laboratory off-site radiological safety and community information programs provided for Milrow. The off-site radiological safety program included operating en-vironmental surveillance networks of air samplers, thermoluminescent dosimeters and gamma-rate recorders before and after the detonation, and fielding 13 radiation monitors for the detonation. All surveillance and monitoring results indicated no increase in radioactivity above background levels in the off-site area following the event. (Houser-NSIC) W71-09027

## HEATED EFFLUENT - AN ASSET TO AGRICULTURE, Washington State Office of Nuclear Energy

Development, Seattle.

For primary bibliographic entry see Field 05C.

W71-09028

TRITIUM IN NEW YORK STATE WATERS,

1965, New York State Dept. of Health, Albany. Kurt Anderson Bureau of Radiological Health. Kurt Anderson.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.50. Radiological Health Data and Reports, Vol. 10, No. 3, p. 93-97, 3 fig, 3 tab, 2 ref,

Descriptors: \*Tritium, \*New York, \*Rivers, \*Lakes, \*Sampling, Explosions, Fallout, Precipitation (Atmospheric), Surface runoff, Surface waters, Waste dilution, Water pollution sources.

The states major rivers, creeks, and lakes were sampled to see what variations in tritium content occurred throughout the state. Since most tritium in the atmosphere from nuclear weapons probably reaches the surface waters in precipitation, one would expect that running water, such as in creeks and rivers (made up of recent precipitation runoff) may be higher in tritium than large, deep lakes that contain older water, thus providing greater dilution (Houser-NSIC) W71-09029

# DISPOSAL OF RADIOACTIVE WASTE FROM U.S. NAVAL NUCLEAR POWERED SHIPS AND THEIR SUPPORT FACILITIES, 1969, Naval Ship Systems Command, Washington, D.C.

Nuclear Power Directorate.

J. J. Mangeno, and M. E. Miles.
For sale by the C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.50. Radiological Health Data and Reports, Vol. 11, No. 8, p. 373-377, 3 tab, 9 ref,

Descriptors: \*Ships, \*Radioactive waste disposal, \*Water pollution sources, \*Water pollution effects, Water pollution control, Monitoring, Oceans, Harbors, Naval architecture, Nuclear energy, Measurement, Discharge, Regulation, Sediments, Radioisotopes, Cobalt, Data collection.

This report summarizes data on disposal of radioactive wastes from U.S. Naval Nuclear-Powered Ships and their support facilities and summarizes results of environmental monitoring performed to confirm adequacy of waste disposal limits and procedures. The waste disposal data presented show that the total long-lived radioactivity in liquid waste discharges associated with operation and maintenance of naval nuclear-powered ships totaled 0.05 curies in 1969 for all harbors. This is comparable to the average of 0.2 curies discharged per year during the preceding 3 years for all har-bors and is less than the average of 4 curies reported discharged per year during the preceding 5 years. Results of environmental surveys of harbor water and bottom sediment for gross radioactivity and for cobalt-60 (Houser-NSIC) W71-09030

#### THE PERCH LAKE EVAPORATION STUDY -THE USE OF RADIOISOTOPES IN HYDROLO-GY, FEBRUARY 1970, VIENNA, AUSTRIA. Atomic Energy of Canada Ltd., Chalk River (On-

Report AECL-3557, February 1970, CONF-700328-2, Paper SM-129/10 at IAEA Symposium on Uses of Isotopes in Hydrology, Vienna, March 9-13, 1970.

Descriptors: \*Hydrologic Cycle, \*Tracers, \*Basins, \*Lakes, \*Tritium, Water vapor, Evaporation, Groundwater, Base flow, Model studies, Water pollution sources.

The primary purpose of the Perch Lake Project is to exploit the use of radioactive tracers in the study of all aspects of the hydrological cycle in a small,

well-defined basin. Within this broad objective, a number of individual studies are being conducted, of which one, the use of tritiated water vapour for the study of evaporation mechanisms in a natural setting, is believed to be unique. Other studies include the determination of the water, tritiated water, energy, and trace-element budgets of the lake, of which the first three complement the use of tritiated water vapour to study basic evaporation mechanisms. Radioactive tracers have been used particularly for estimating the ground-water com-ponents of the water and tritium budgets. Groundwater flows predicted by the use of conventional hydrological techniques as well as various new models are being compared with the results obtained by using radioactive tracers. (Houser-NSIC) W71-09032

# TRITIUM INJECTION AND CONCENTRATION DISTRIBUTION IN THE ATMOSPHERE, International Atomic Energy Agency, Vienna

(Austria). W. R. Schell, G. Sauzay, and B. R. Payne. Journal of Geophysical Research, Vol. 75, No. 12, p. 2251-2266, April 20, 1970.

Descriptors: \*Tritium, \*Tracers, \*Atmosphere, \*Model studies, \*Injection evaporation, Water vapor, Condensation, Meteorology, Parametric hydrology, Fallout, Precipitation (Atmospheric), Deuterium, Oxygen.

The use of environmental tritium as a water tracer has significantly increased our understanding of hydrological processes. Because of the large stratospheric reservoir of tritium produced by nuclear detonations and the relatively slow mixing rates between the stratosphere and the troposphere, studies of meteorological parameters of transport and diffusion can be made over many years. If the nuclear test ban treaty is observed and if no more large atmospheric nuclear detonations are conducted, the seasonal and annual changes in the atmospheric tritium distribution can give important information on the hydrological cycle and on meteorological effects. This paper relates strato-spheric injection for a water tracer to the concentration of tracer in precipitation by means of meteorological parameters. A simplified model has been developed that relates injection, exchange, evaporation, condensation of water vapor, and tritium to meteorological parameters in the troposphere. Since the form of the model is general, tritium, fallout radionuclide, deuterium, and oxygen 18 data can be used as tracers to test the basic assumptions and to examine the physical processes that are occurring. The model was tested with meteorological data and tritium concentrations in precitation from the IAEA/WMO World Network of sampling stations. The results of the initial application of the model to western Europe are presented. (Houser-NSIC) W71-09033

#### TRITIUM GEOPHYSICS AS AN INTERNA-TIONAL RESEARCH PROJECT. California Univ. San Diego, La Jolla.

H. E. Sucss.

Science, Vol. 163, March 28, 1969, p. 1405-10.

Descriptors: \*Geophysics, \*Tritium, \*Water vapor, \*Tracers, \*Precipitation (Atmospheric), \*Oceans, \*Runoff, \*Surface water, Surveys, Ground water, Surface drainage, Economics, Meteorology, Water pollution sources.

Tritium is produced by cosmic ray on the order of 30 atoms per square centimeter of the earth's surface per minute. During 1961 and 1962 quantities of tritium greatly in excess of those naturally present were released artificially into the atmosphere by testing of hydrogen bombs. This amount can be estimated from the observed tritium content of precipitation and of the surface water of the oceans to be of the order of 105 grams. At this time all the water present on the surface of the earth, in the form of water vapor in the at-

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mosphere, of cloud droplets, precipitation, and surface water is tagged with a measurable amount of tritium. This situation affords us with a unique opportunity to study the behavior of water of our engreat scientific or economic importance. A program has been initiated by the IAEA to make use of this opportunity. (Houser-NSIC)

LOW AMBIENT LEVEL UPTAKE OF 14C-DDT BY THREE SPECIES OF MARINE PHYTOPLANKTON, Stanford Univ., Pacific Grove, Calif. Hopkins

Marine Station.

For primary bibliographic entry see Field 05A. W71-09035

**AERIAL PHOTOGRAPHY OF OIL SLICKS.** Field Studies Council, Pembroke (England). Oil Pollution Research Unit.

For primary bibliographic entry see Field 05A. W71-09046

SEDIMENT, OUR GREATEST POLLUTANT, Agricultural Research Service, Oxford, Miss. Sedimentation Lab.

A. R. Robinson.

Paper 70-701, 1970 Winter Meet, American Society of Agricultural Engineers, Chicago, III, Dec 1970. 15 p, 16 ref.

Descriptors: \*Sediments, Sediment production, \*Sediment transport, Bibliographies, Deposition, Pollutants, \*Water pollution, Erosion, Soil erosion, Turbidity, Chemical properties, \*Pesticide residues, Solutions, Water resources, Fish conser-\*Pesticide vation, Eutrophication, Flood plains. Identifiers: Soil deposits.

Sediment becomes a pollutant when it occupies water storage reservoirs, fills lakes and ponds, clogs stream channels, settles on productive lands, destroys aquatic habitat, and creates turbidity that detracts from recreational use of water. As a result, sediment degrades water for consumptive or other uses, increases water treatment costs, and damages water distribution systems. Sediment is the carrier of other pollutants such as plant nutrients, insecticides, herbicides, and heavy metals. There is also evidence that bacteria and virus are carried by sediments. Primarily, the larger sediment particles are most readily controlled by available technology; finer particles are the principal carriers, more active chemically, and transported farther before deposition. Sediment is our greatest pollutant of waters in terms of volume, but in some instances, may actually remove and deposit pollutants from solution. In this case, sediment acts as a scavenger. (USBR) W71-09055

DISPERSION IN HETEROGENEOUS NONU-NIFORM ANISOTROPIC POROUS MEDIA, Purdue Univ., Lafayette, Ind. School of Chemical

Engineering. Robert A. Greenkorn.

Copy available from GPO Sup Doc, \$1.00; microfiche from NTIS as PB-200 258, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series Report, September 1970. 82 p, 28 fig, 8 tab, 28 ref, 3 append. EPA Grant 16060 DLL (Formerly WP-101048-03).

Descriptors: \*Dispersion, \*Porous media, \*Soil water movement, \*Groundwater movement, \*Path of pollutants, Mixing, Anisotropy, Non-uniform flow, Hydraulic models, Mathematical models, Tracers, Statistical models.

Identifiers: \*Nonuniform anisotropic porous

An understanding of the dispersion phenomenon is necessary to predict flow of miscible fluids in nonhomogeneous porous media. A literature review of dispersion in nonhomogeneous porous media was made and the continuum and statistical theories of flow in porous media were used with experiments ls of unconsolidated porous media to study the effects of heterogeneity, nonuniformity, and anisotropy on dispersion. Dispersion changes significantly with permeability. When models of different permeability are connected, the dispersive effect is not reciprocal. Dispersion changes significantly with nonuniformity. Likewise there is a significant effect when models of different nonuniformity are interconnected (second-order heterogeneity). Anisotropy was included in two kinds of models (linear and radial) by packing alternate layers of beads causing flow through these layers at different angles. The results have practical application, especially in tracing contaminants in surface and subsurface flow such as movement of pesticides, fertilizers, acid mine drainage, and feed-lot waste through the soil. (Knapp-USGS) W71-09079

# PERSISTENT PESTICIDES IN THE ENVIRON-

Rothamsted Experimental Station, Harpenden

(England). Clive A. Edwards.

Originally published as CRC Critical Review in Environmental Control, Vol 1, No 1, Feb 1970. (See W70-05057). Cleveland, Ohio, CRC Press (Division of Chemical Rubber Co), 1970. 78 p, 3 fig, 24 tab, 322 ref, append.

Descriptors: \*Pesticide residues, \*Hazards, \*Pollutants, \*Reviews, \*Bibliographies, Fishkill, Pesticide kinetics, Distribution patterns, Path of pollutants, Pesticide toxicity, Pesticide removal, Public health, Water pollution sources, Pesticide drift, Water quality, Environment, Ecology. Identifiers: Persistent pesticides.

Some of the more important pesticide residue surveys and experimental studies of residues in both the physical and biological sections of the environment are summarized in order to assess the present state of knowledge of the status of pesticide residues in the environment. Recent data are presented on the amounts of residues in all compartments of the environment to show how they are concentrated from the physical to the biological parts of the environment and into the upper trophic levels of food chains. The most difficult thing to assess from data currently available is not what the present situation is, but what changes will occur if certain actions, for example a ban on a particular pesticide, are taken. The cycling of pesticides in the environment is summarized to illustrate the movements of residues through the various compartments of the environment. A bibliography of 322 entries is included. (Knapp-USGS) W71-09088

#### **ENVIRONMENTAL MERCURY RESEARCH IN** SWEDEN,

Environment Swedish Protection Board. Stockholm.

J. E. Larsson.

Swedish Environment Protection Board Report, June 1970. 44 p, 3 fig, 4 tab, 56 ref.

Descriptors: \*Heavy metals, \*Poisons, \*Metal organic pesticides, \*Water pollution effects, Pathology, Reviews, Path of pollutants, Public health, Bibliographies, Chemical wastes, Water pollution Bibliographies, Chemical wastes, Water pollution sources, Regulation, Human pathology, Food chains, Fallout, Fishkill, Toxicity, Water quality, Biochemistry, Bottom sediments.

Identifiers: \*Mercury, \*Methyl mercury, \*Heavy settle proper (Marcury)

metal poisons (Mercury).

The circumstances under which the mercury problem in Sweden was discovered are discussed, with a review of the research which was initiated as its consequence. Research outside Sweden is reported only when it has a direct influence on Swedish mercury research. The decisions of administrative authorities in the mercury field are re-

ported with the effects of these decisions and measures. Comprehensive evidence documents the connection between the introduction of alkylmercury-containing seed disinfectants and increased content of mercury in the feathers and livers of birds, in particular birds of prey. In the water environment, extended investigations show increased mercury content of bottom sediment and fish in areas which are influenced by industrial pollution. Contaminated fish led to 'black listing' of several inland waters and some bays along the Swedish coast. Animal experiments show that methylmercury is metabolized slower than all other investigated mercury compounds. Experiments on animals show that methylmercury causes damage to the central nervous system and has an effect on hereditary mechanisms. Research in progress is mainly concentrated on the water environment. Mercury fallout is studied by sampling of air and precipitation and by analyses on lichens and mosses. Studies include the effects of methylmercury on behavior and learning, hereditary mechanisms, the detoxifying capacity of the liver, the metabolism of steroid hormones, and on the breeding results of fish. (Knapp-USGS) W71-09089

# HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 02E. W71-09103

# MERCURY-MAJOR NEW ENVIRONMENTAL

PROBLEM, New York State Dept. of Environmental Conserva-tion, Albany. Bureau of Fish. Carl E. Parker.

The Conservationist, August-September, p 6-9, 1970, 3 fig.

Descriptors: \*Heavy metals, \*Water pollution sources, \*Public health, Human pathology, Fish, Standards, Great Lakes, Air pollution effects, Pesticides, Agriculture, Aqua\*ic animals, Food chains, Sampling, New York.
Identifiers: \*Mercury, Sweden, Toxic levels.

The present critical status of water pollution with mercury is reviewed. By the food-chain concentra-tion, mercury of industrial wastes and pesticides attains extremely dangerous levels of toxicity in fish flesh. As shown by recent studies, mercury affects adversely the entire man's organism culminating in permanent brain damage; in several instances mercury-contaminated fish caused multiple deaths. The arbitrary tolerance levels in food vary at this time from 0.05 ppm, suggested by the World Health Organization/Food and Agriculture Organization, to 1.00 ppm, acceptable by Sweden. However, even the latter, highly questionably con-centration will not permit either commercial or sport fishing in many water basins of the world. Analyses of water fowl and upland birds are likely to effect a drastic reduction of hunting. The solution of the mercury problem is hindered by the stubborn resistance of both industry and agriculture--a resistance pregnant with dire consequences. Thus far the burden of responsibility was on the Department of Fish and Wildlife, but in the future, mercury will be one of the major preoccupations of the new Department of Environment Conservation. (Wilde-Wisconsin) W71-09164

#### BOMB CARBON-14 IN DEEP SEA ORGAN-ISMS.

California Univ., San Diego; and Washington Univ., Seattle. P. M. Williams, J. A. McGowan, and M. Stuiver.

Nature, Vol 227 (5256), p 375-376, 1970.

Descriptors: \*Carbon radioisotopes, \*Marine plants, \*Phytoplankton, \*Zooplankton, Food chains, Sea water, Vertical migration, Productivity,

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5B—Sources of Pollution**

Sampling, Crustaceans, Hawaii, Pacific Ocean, Fallout, Water pollution effects, Water pollution sources, Path of pollutant.

The input of C-14 to the atmosphere from nuclear weapons tests is reflected in the C-14 activity in surface seawater. Surface water Zooplankton, in equilibrium with surface C-14 levels, contain more C-14 than (bathypelagic) fish and crustaceans at lower levels. (Bopp-NSIC) W71-09181

#### RADIOACTIVE POLLUTION OF RIVERS IN CZECHOSLOVAKIA,

Ustav Hygieny, Prague (Czechoslovakia). Borivoj Havlik.

Health Physics, Vol. 19, p 617-624, Nov. 1970. 5 fig, 4 tab, 17 ref.

Descriptors: Water pollution effects, \*Mining, \*Uranium radioisotopes, \*Radium radioisotopes, Potassium radioisotopes, Background radiation, Rivers, Streams, Absorption, Biota, Plankton, Aquatic plants, Sediments, Fallout, Water pollution control, Recirculated water, Water pollution sources, Mine drainage, Domestic water.

One of the oldest uranium mining areas in the world is the spa Jachymov in Bohemia. A study of environmental contamination began there when uranium mining was at a maximum, and continued until mining ceased 6 years later. Content of radium-226 and total beta activity of water, river sediments and water plants were estimated in the streams of this area and from the other uranium ore area, where mining reached its maximum during the study period. Radioactive pollution of the major Czechoslovak rivers during 1964-67 is described. (Bopp-NSIC) W71-09183

#### STUDY OF THE PHYSICAL CHEMISTRY OF RUTHENIUM IN SEA WATER, (IN FRENCH),

Commissariat a l'Energie Atomique, La Hague (France).

Pierre Guegueniat.

Available from the National Technical Information Service as LEA-R-4125, \$3.00 in paper copy, \$0.95 in microfiche. Report CEA-R-4125, Dec. 1970. 22 p.

Descriptors: \*Sea water, \*Physicochemical properties, \*Radioisotopes, Colloids, Solubility, Sediments, Water pollution effects, Nuclear wastes, Sedimentation, Absorption, Adsorption, Water pollution sources.

Identifiers: \*Ruthenium radioisotopes.

The insoluble forms of ruthenium are sedimented. but soluble forms are carried away to the open sea. The importance of sediments in the contamination of marine organisms was shown in earlier experiments. The present chemical study shows that areas needing further work for clarification of ruthenium contamination are: (1) colloidal ruthenium compounds, (2) absorption on precipates formed when nuclear wastes are discharged into the ocean, (3) absorption by ocean sediments. (Bopp-NSIC) W71-09184

# PATHWAYS OF TRACE ELEMENTS IN ARC-TIC LAKE ECOSYSTEMS. PROGRESS RE-PORT, APRIL 15, 1970-APRIL 14, 1971, Alaska Univ., College. Inst. of Marine Sciences.

For primary bibliographic entry see Field 05C. W71-09190

## A COMPUTER BASED FLORISTIC ANALYSIS OF PAMLICO RIVER PHYTOPLANKTON, East Carolina Univ., Greenville, N.C. Dept. of

For primary bibliographic entry see Field 05A. W71-09211

RADIOLOGICAL SURVEILLANCE STUDIES AT A BOILING-WATER NUCLEAR POWER REACTOR,

Environmental Health Service, Cincinnati, Ohio. B. Kahn, R. L. Blanchard, and H. L. Krieger. Availability: UNIPUB, Inc, PO Box 433, New York, NY. International Atomic Energy Agency, Symposium 146-26, p 537-548, New York, Aug 10-14, 1970. 19 p, 10 tab.

Descriptors: \*Radioisotopes, \*Effluents, \*Environment, \*Surface waters, \*Radiation, \*Nuclear power plants, Pollutants, Water pollution control, Water pollution sources, Water pollution treatment, Analytical techniques.

Radionuclides in water, gases, and airborne particles were measured at the Dresden Nuclear Power Station and in its environment in order to provide the technical basis for surveillance programmes at nuclear power stations. Concentrations of radionuclides in the primary coolant and the offgas were determined on several occasions. At the same time, radioxenon concentrations and external radiation exposures were measured near the plume within 1-2 km of the stack, and the radionuclide content of effluent water was measured near the point of discharge. Samples of food, feed, and water from the immediate environment were also analyzed for specific radionuclides. Results of radionuclide analyses and radiation exposure calculations are presented. (Houser-NSIC)

#### **ENVIRONMENTAL ASPECTS OF KARACHI** NUCLEAR POWER PLANT,

Pakistan Atomic Energy Commission, Karachi. M. Nasim.

Availability: UNIPUB, Inc, PO Box 433, New York, NY. International Atomic Energy Agency Symposium 146-51, p 781-789, New York, Aug 10-14, 1970. 10 p.

Descriptors: \*Nuclear power plants, \*Effluents, \*Pollutants, \*Path of pollutants, \*Surface waters, Water pollution control, Water pollution sources, Radiation, Radioisotopes, Population, Food chains, Diets, Oceans,

To ensure that environmental dose limits for routine exposures are not exceeded, a program for the environmental survey of the site has been started. Environmental surveillance data would also be used as a basis for estimating population exposure. The program is basically directed at the identification of possible routes (exposure pathways) of contamination to the population. These include air and water pathways and fish and agricultural crops. (Houser-NSIC) W71-09236

## THE EFFECT OF URANIUM MINING AND MILLING ON POLLUTION OF RIVERS IN CZECHOSLOVAKIA,

Ustav Hygieny, Prague (Czechoslovakia). B. Havlik

Availability: B Havlik, Institute of Hygiene, Srobarova 28, Prague 10, Czechoslovakia. Health Physics, Vol 17, No 2, p 386-387 (Aug 1969).

Descriptors: \*Water pollution, \*Pollution abatement, \*Water pollution control, \*Water pollution sources, \*Watersheds (Basins), \*Surface waters, Mining, Radioactivity, Radioactivity effects, Radioisotopes.

A study of environmental contamination when the uranium mining was at a maximum and continued for 6 years, when mining ceased. These long term investigations enabled one to arrive at practical recommendations for protection of surface waters during all phases of mining activities. (Houser-W71-09237

DOSE ESTIMATION STUDIES RELATED TO PROPOSED CONSTRUCTION OF AN ATLAN-TIC-PACIFIC INTEROCEANIC CANAL WITH NUCLEAR EXPLOSIVES: PHASE III, Oak Ridge National Lab., Tenn. Health Physics

Stephen V. Kaye, and Paul S. Rohwer. Availability: NTIS. ORNL-4579, Dec 1970, 145 p, 18 tab, 6 fig, 7 append.

Descriptors: \*Canals, \*Canal construction, \*Canal Zone, \*Atlantic Ocean, \*Pacific Ocean, \*Nuclear explosions, Pollutants, Water pollution, Soil conramination, Pollution abatement, Population, Radioecology, Radioactivity effects, Diets, Environmental effects, Environmental gradient.

This document is the final report covering contributions of the Health Physics Division of Oak Ridge National Laboratory (ORNL) to the Bioenvironmental Radiological Safety-Feasibility Study of a sea-level canal excavated with nuclear explosives. Potential doses to indigenous populations along Route 17 in eastern Panama and Route 25 in northwestern Colombia were estimated for a combination of hypothetical exposures to radiation. The studies attempted to determine when it might be appropriate for the evacuated populations to reenter areas adjacent to the two routes. The only modes of exposure considered were external exposure to a contaminated land surface and internal exposure from the ingestion of four types of contaminated foods and beverages. Parameters in the internal dose models were adjusted to differentiate five age groups within each of four indigenous populations and nine reference organs. These populations were further differentiated on the basis of diet and estimates of time- and age-dependent concentrations of radioactivity in dietary items. (Houser-NSIC) W71-09238

#### THE BRITISH APPROACH TO ENVIRONMEN-TAL MONITORING,

United Kingdom Atomic Energy Authority, London (England). Authority Health and Safety

H. J. Dunster, A. W. Kenny, W. T. L. Neal, and A.

Nuclear Safety, Vol 10, No 6, p 504-513 (Dec 1969).

Descriptors: \*Environment, \*Monitoring, \*Regula-tion, \*Radioactivity effects, Waste water pollution, Waste water disposal, Water pollution control, Water pollution sources, Nuclear reactors, Nuclear wastes, Effluents, Oceans.

Environmental monitoring forms an integral part of arrangements in Britain for controlling radiation exposure of the public. When detectable exposure to radiation occurs, the 'critical pathway' is used to establish the dose received by the 'critical' population group. When no increase in exposure can be detected, the simplest possible indication systems are used to ensure that no significant change in the situation occurs. (Houser-NSIC) W71-09240

#### RADIOECOLOGY OF CESIUM-137 STRONTIUM-90 IN A FOREST,

Institute of Public Health, Tokyo (Japan); Kiryu Coll. of Technology (Japan); and Japan Analytical Chemistry Research Inst., Tokyo. Noboru Yamagata, Shunji Matsuda, and Morito

Journal of Radiation Research (Tokyo), Vol 10, p 107-112 (Sept-Dec 1969). 2 fig, 7 tab, 3 ref.

\*Strontium radioisotopes, \*Coniferous forests, Absorption, Ecosystems, Food chains, Soil-water-plant relationships, Shrubs, Root zone, Fallout, Runoff, Water pollution sources. Identifiers: \*Cesium radioisotopes.

The highest concentration of both radionuclides was found in the fallen leaves and this can be

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reasonably explained by the fact that the fallout rates were the highest three years ago. About 80% and 63% of the total deposition, respectively, of cesium-137 and strontium-90 were found in the upper 5 cm layer of soil; 18% and 23% in the vegetation, of which 11.4% and 10.7% were in fallen leaves. Uptake of strontium-90 by the pine tree and shrub roots was at least twice that of cesium-137. (Bopp-NSIC) W71-09241

## POLLUTION OF A MARINA AREA BY WATERCRAFT USE AS INDICATED BY COLIFORM AND CHEMICAL CONCENTRA-TIONS.

Michigan State Univ., East Lansing. Dept. of Microbiology; and Michigan State Univ., East Lansing. Inst. of Water Research.
W. N. Mack, and F. M. D'ltri.

Available from the National Technical Information Service as PB-200 622, \$3.00 in paper copy, \$0.95 in microfiche. Michigan State University Project Completion Report, May 1971. 15 p, 2 fig, 6 tab, 10 ref. OWRR Project A-038-MICH (1).

Descriptors: \*Water pollution sources, \*Bioindicators, \*Coliforms, \*Michigan, Marinas, Boats, Docks, Harbors, Inland waterways, Lake Michigan, Recreation, Boating, Water sports. Identifiers: Watercraft pollution.

Samples of water from a marina area in Michigan used by watercraft were tested for the number of coliform organisms. There was a slight increase in the coliform most probable number of organisms in the slips most frequently used by the yachts. Outside sources of contamination probably added to the total number of organisms present in the area. Although an increase in the number of organisms was related to the presence of yachts in the marina, the concentration was far below the standard of total body contact as established by the Water Quality Standards for Michigan Intrastate Waters. Chemical analysis of water samples taken at the marina were all within the normal limits for the specific area. Other factors contributing to the presence of the coliform organisms in this relatively unpopulated area were considered. (Knapp-USGS) W71-09270

## PERSISTENCE OF PESTICIDES IN RIVER

Environmental Protection Agency, Cincinnati, Ohio. Water Quality Office.

James W. Eichelberger, and James J. Lichtenberg. Environmental Science and Technology, Vol 5, No 6, p 541-544, June 1971, 4 p, 2 tab, 11 ref.

Descriptors: \*Persistence, \*Pesticide kinetics, \*Biodegradation, \*Pesticide residues, \*Chemical degradation, Chlorinated hydrocarbon pesticides, Rivers, Surface waters, Carbamate pesticides, Organophosphorus pesticides, Chemical analysis, Path of pollutants.

Identifiers: Pesticide persistence.

The persistence of 28 common pesticides in raw river water was studied over an eight-week period. Twelve organochlorine, nine organophosphorus, and seven carbamate pesticides were studied at a concentration of 10 micrograms/liter. No measureable degradation or chemical change was observed for the following organochlorine compounds: BHC, heptachlor epoxide, dieldrin, DDE, DDT, DDD, and endrin. Azodrin was the only or-ganophosphorus compound that was stable throughout the study. All carbamate compounds were significantly changed after one week, and all but Baygon were completely lost after eight weeks. Where possible, the degradation or chemical conversion products of the pesticides were identified. (Knapp-USGS) W71-09272

## CHANGES IN THE CHEMICAL COMPOSITION OF SEDIMENTS OF LAKE WASHINGTON, 1958-1970,

Minnesota Univ., Minneapolis. Limnological Research Center; and Washington Univ., Seattle. Dept. of Zoology.

Joseph Shapiro, W. T. Edmondson, and David E.

Technical Report, 1971. 24 p, 1 tab, 22 ref. OWRR Project B-009-MINN (3).

Descriptors: \*Water pollution effects, \*Bottom sediments, \*Eutrophication, \*Water pollution conrol, \*Washington, Phosphates, Nitrogen, Organic matter, Cores, Limnology, Nutrients, Water quali-ty, Monitoring, Sampling, Data collections. Identifiers: \*Lake Washington.

Three cores were taken in deep water in different parts of Lake Washington in 1958 and 1959 and two cores were taken at one of the same locations in 1968 and 1970. During the interval between the two sets of cores, all the sewage effluent causing eutrophication of the lake was diverted, and the lake began to regress to a relatively unproductive condition. All the cores show higher concentrations of organic matter, phosphorus and nitrogen in the top few centimeters than deeper. Lake Washington is a particularly good subject for a study of this kind. Before 1963, as a result of continuing increases in sewage effluent entering it, the lake became more and more productive. Since 1963, as a result of a program of diversion of the effluents to Puget Sound, the lake has shown significant regression toward its earlier condition. Cores have been taken in a similiar fashion and in the same localities for about 12 years. (Knapp-USGS)

## MERCURY IN A COASTAL MARINE EN-

VIRONMENT, Southampton Univ. (England). For primary bibliographic entry see Field 05A. W71-09293

## FORMATION OF METHYL MERCURY FROM PURE MERCURIC SULPHIDE IN AEROBIC ORGANIC SEDIMENT, Swedish Water and Air Pollution Research Lab.,

Stockholm.

Torbjorn Fagerstrom, and Arne Jernelov. Water Research, Vol 5, No 3, p 121-122, March 1971. 2 p, 1 fig, 3 ref.

Descriptors: \*Heavy metals, \*Poisons, \*Sulfides, \*Bottom sediments, \*Metal organic pesticides, Path of pollutants, Water chemistry, Water pollution sources, Water pollution effects, Hydrogen sulfide, Chemical reactions, Water pollution control. Biochemistry

Identifiers: \*Mercury, \*Methyl mercury.

The formation of methyl mercury from pure mercuric sulphide in aerobic organic sediments was studied. Methyl mercury is formed, but the speed of the methylation process is considerably lower compared to control series using inorganic divalent mercury. Periodic occurrence of hydrogen sul-phide in bottom water and sediments is thus of importance for the turnover of mercury in an aquatic ecosystem. For restoring mercury-contaminated bodies of water the artificial binding of mercury as sulphide might be a possibility. At very high con-centrations (over 500 ppm Hg) there is a decrease in the amount of methyl mercury formed due to the toxic effects of inorganic divalent mercury on the methylating organisms. In this situation mercury binding as mercuric sulphide might increase the methylation activity due to reduced toxicity. (Knapp-USGS) W71-09296

#### WHERE DOES WATER QUALITY IMPROVE-MENT BEGIN,

Agricultural Research Service, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch.

Elmer E. Jones, Jr. Ground Water, Vol 9, No 3, p 24-28, May-June 1971. 5 p, 5 fig, 10 ref.

Descriptors: \*Groundwater movement, \*Path of pollutants, \*Water pollution sources, \*Water wells, Malenclaves, Water sources, Domestic water, Well regulations.
Identifiers: Domestic well protection.

Most groundwater aquifers have a multibarrier natural defense system. With all these natural defenses, in most cases of contamination, the well itself is the path of entrance for the contamination. Only in very rare circumstances is it economically justified to substitute disinfection for adequate protection of a groundwater source. Rapid changes in well water quality with pumping time indicate less than optimum construction. Poorly constructed and abandoned wells serve as unauthorized and uncontrolled groundwater recharge points and have a degrading effect on groundwater quality. Water quality improvement should begin with excluding water of undesirable quality from the source of supply. For the home owner and farmer to profit from this ideal it must be accepted by well drillers, water conditioning dealers, and county and State healty departments. (Knapp-USGS) W71-09300

## FIELD STUDY OF SUBSURFACE SPENT SULFITE LIQUOR MOVEMENT USING EARTH RESISTIVITY MEASUREMENTS,

Research Council of Alberta, Edmonton. Earth Sciences Branch.

Douglas A. Hackbarth.

Groundwater, Vol 9, No 3, p 11-16, May-June 1971. 7 p, 2 fig, 7 tab.

Descriptors: \*Path of pollutants, \*Sulfite liquors, \*Tracking techniques, \*Electrical studies, \*Scepage, Soil water movement, Groundwater movement, Geophysics, Tracers, Malenclaves, Waste disposal, Water pollution sources, Piezometers, Sampling, Water levels. Identifiers: Earth resistivity studies.

A new method is presented for supplementing data from piczometers to monitor waste disposal sites. This method involves examination of a time sequence of resistivity measurements at fixed points in a disposal area. Spent sulfite liquor moving away from a secpage pit was traced by examining a grid of earth resistivity measurements made before and after dumping had taken place. The method appears to provide results which correlate with specific conducitivity of water samples from piczometers provided the following conditions are shallow depth; (2) water table close to surface; (3) uniform soil and vegetative conditions; and (4) proper selection of electrode spacings. (Knapp-USGS) W71-09302

## POLLUTION PROBLEMS IN THE 'OIL PATCH', Geological Survey, Denver, Colo. John W. Rold.

American Association of Petroleum Geologists Bulletin, Vol 55, No 6, p 807-809, June 1971. 3 p,

Descriptors: \*Water pollution sources, \*Water pollution control, \*Oil industry, \*Oil fields, Injection wells, Oily water, Brines, Water wells, Monitoring, Path of pollutants. Identifiers: Oil spills.

Throughout much of the 'oil path' water exemplifies the economic, sociologic, political, and ecologic lifeblood of the community. The permanent supply of usable water, on which the arid west depends for survival, faces many hazards. Currently, much available water exceeds or is rapidly approaching public health limits and the tolerance level of the inhtants. Oil field practices can and do pollute water, mainly by increasing total dissolved

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5B—Sources of Pollution**

solids (principally chlorides and sulfates), but also by releasing crude oil. Pollution may occur from several sources including evaporation pits, insufficient surface casing, abandoned wells, oil spills, and seismic shotholes. The solution of this problem requires a constant awareness of the value of fresh water, the habitat of groundwater, and the pollu-tion potential of each operation. Constant planning, monitoring, and policing of the operation will not only prevent pollution, but will improve the industry's image and save oil companies money. (Knapp-USGS)
W71-09303

#### LAKE ERIE ALIVE BUT CHANGING,

Michigan Univ., Ann Arbor. Great Lakes Research

The Conservationist, Vol. 25, No. 3, p. 23-30, Dec. - Jan 1970-71, 3 figures.

Descriptors: \*Water pollution sources, \*Pollution abatment, \*Fisheries, Lake Erie. Identifiers: Detroit River, Maumee River.

This article describes the problematic ecological situation into which Lake Erie has evolved, the causes of this condition, the effects of it and the possible solutions. The fisheries industry is a major focus of the article, suggesting ways for bringing it back to the lake as well as a detailed examination of what species of fish have been eliminated from Lake Eric and what new species have been in-troduced. The author concludes that 'if changes of some sort are not made in man's use and misuse of the Lake Erie resource, he will lose it entirely.' (Holmes-Rutgers) W71-09409

#### STAGNANT SEA.

Goteborg Univ. (Sweden). Stig H. Fonselius.

Environment, Vol. 12, No. 6, p 2-48 July/August 1970, 14 references.

Descriptors: \*Water pollution sources, \*International waters, \*Economics, \*Political aspects.
Identifiers: \*Baltic Sea, International Council for Exploration of the Sea.

The Baltic Sea has been the object of scientific and economic interest for decades. It is an important trade waterway for seven countries in Northern Europe. This article describes the natural and manmade sources of pollution to the Baltic Sea and what the nations working together have already accomplished and plan to accomplish to control these pollutants. Although several 'fanciful suggestions,' as the author explains have been discussed, the political and economic aspects of any pollution control measures have to be carefully considered. (Holmes-Rutgers) W71-09415

#### 1969 FISH KILLS CAUSED BY POLLUTION (STATISTICAL REPORT).

For sale by the Superintendent of Documents, US Government Printing Office, Washington DC -Price \$0.20. Federal Water Quality Administration, 1970. 20 p, 14 tab.

Descriptors: \*Fishkill, \*Water pollution effects, \*Water pollution sources, Contamination (Water), Agricultural chemicals, Industrial wastes, Mu-nicipal wastes, Sewage effluents, Fertilizers, Mine

An estimated 41 million fish were killed by pollution in 1969, 15 million more than were killed in 1968. The Federal Water Quality Administration has compiled data on fish kills from every state except Hawaii, Nevada, North Dakota, Mississippi, and Maryland. Five general sources of pollution-agricultural operations, industrial operations, municipal operations, transportation operations, and

other operations--are statistically related to the kills. The data is presented in the form of a data kills. The data is presented in the form of a data review, state kill report highlights, and fourteen fish kill tables. These tables depict an historical summa-ry of kills, a summary of sources of pollution, a summary of kills by state, an analysis of types of water and seasonal incidence of kills, the severity of kills, and a cumulative listing of fish kills. (Kohla-Florida)

#### 5C. Effects of Pollution

#### TOXICITY OF SEA WATER TO COLIFORM BACTERIA,

Metcalf and Eddy, Boston, Mass. For primary bibliographic entry see Field 05A.

## EFFECTS OF INCREASED TEMPERATURE ON

COLD-WATER ORGANISMS,
National Marine Fisheries Service, Seattle, Wash. George R. Snyder, and Theodore H. Blahm.
Journal Water Pollution Control Federation, Vol
43, No 5, May 1971, p 890-899. 6 fig, 3 tab, 26 ref.

Descriptors: \*Aquatic environments, \*Thermal pollution, Hydroelectric plants, Nuclear power plants, \*Temperature, Anadromous fish, Salmon, Trout, Fishkill, Mortality, Nitrogen, Saturation, Metabolism, Flow, Spawning, Fisheries, Pacific Northwest U.S., Water pollution effects. Identifiers: \*Thermal block.

Many investigations dealing with laboratory tests performed on cold water fishsubjected to warmer waters have been reported. The mortality of fish subjected to warmer water is an accepted phenomena, but the mechanisms, in many instances, are still unknown. Also, no significant data has been compiled under actual stream conditions. Many of the aquatic organisms of the Pacific Northwest have been demonstrated to have low tolerance to the temperature increases, and much actual field research is needed to define more clearly the thermal tolerance and survival of these organisms over a wide range of environmental conditions. Predictions have been made for a 16-fold increase in electric power generating plants in this region, and without adequate controls and nowledge, waste heat discharges may destroy, debilitate, or dislodge, portions of the aquatic biota. On the other hand, waste heat discharge have also been shown to be beneficial in some instances. although the benefits are more likely to accrue to saltwater habitats, especially man-made canals ponds, and raceways, than to natural freshwater habitats. Increased understanding of temperature effects may remove harmful side effects and provide increased benefits in other areas. (Lowry-Tex-W71-08950

# ANALYSIS OF WATER FOR MOLECULAR HYDROGEN CYANIDE, North American Rockwell Corp., Athens, Ga.

Rocketdyne Div. For primary bibliographic entry see Field 05A. W71-08952

## NUTRIENTS AND NUTRIENT BUDGET IN THE BAY OF QUINTE, LAKE ONTARIO, Ontario Water Resources Commission, Toronto.

M. G. Johnson, and G. E. Owen.

Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 836-853. 8 fig, 7 tab, 37 ref.

Descriptors: \*Nutrients, \*Nitrogen, \*Phosphorus, Algae, \*Eutrophication, Aquatic environments, Great Lakes, Bays, Watersheds (Basins), Surface drainage, Municipal wastes, Industrial wastes, Sampling, Water quality control, Cost analysis, Waste water treatment, Nutrient requirements. Identifiers: Bay of Quinte, \*Lake Ontario.

Algae blooms in the Bay of Quinte, Lake Ontario, Algae blooms in the Bay of Quinte, Lake Ontario, have been increasing in severity and length over the past several years. Examination of aquatic life in the bay revealed an overwhelming predominance of organisms which readily function in organically rich waters. Input to the bay was monitored in 1968. During that time, the bay received 9.7 million lbs of nitrogen and 731,000 lbs of phosphates from all sources. Approximately 90% of the entering nitrogen entered via the rivers which empty into the bay, and these same rivers accounted for 60%. ing introgen entered via the rivers which empty into the bay, and these same rivers accounted for 60% of the phosphorus input. The remaining 10% of the nitrogen and 40% of the phosphorus was con-tributed from municipal-industrial sources. How-ever, municipal-industrial flows are high strength low volume effluents which displace only a small volume of water from the lake. On the other hand, river flows are extremely low strength high volume additions to the bay which displace large volumes of water. Therefore, it was essential to consider the net additions of P and N rather than the total additions, the net addition being the amount of nutrient contained in an input which is in excess of the amount of nutrients contained in the volume of water displaced at the outlet. On this basis, 50% of the net nitrogen and 85% of the net phosphorus were contributed by municipal-industrial sources. Phosphorus removal from high concentration, low volume inputs, at a cost of \$200,000 per year was recommended. (Lowry-Texas) W71-08953

# A SIMPLE METHOD FOR THE BIOLOGICAL ASSESSMENT OF THE EFFECTS OF WASTE DISCHARGES ON AQUATIC BOTTOM-DWELLING ORGANISMS, Virginia Polytechnic Inst., Blacksburg, Va. For primary bibliographic entry see Field 05A. W71-08954

# EFFECTS OF CADMIUM, ZINC, MANGANESE AND CALCIUM ON OXYGEN AND PHOSPHATE METABOLISM OF BLUEGILL LIVER MITROCHONDRIA,

Illinois Natural History Survey, Urbana, Ill. Robert C. Hiltibran.

Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 818-823. 3 tab, 25 ref.

Descriptors: \*Heavy metals, Fish, \*Fish toxins, Chemical wastes, \*Toxicity, Aquatic environments, Manganese, Oxygen, Calcium, Metabolism, Phosphates, Hydrolysis, Coagulation, Precipitation, Wildlife conservation, \*Sunfishes. Identifiers: \*Mitochondria, Zinc, Cadmium.

Native wild bluegills were held in aerated aquaria, maintained at 25 deg C, for testing to determine the toxicity of various metal ions. Parameters monitored were the oxygen and phosphate uptake of the mitochondria. In the presence of succinic acid, oxygen uptake by the blue gill mitochondria was severely altered by: (1) 3.3 x 10-3 microns moles Cd ml of reaction medium; (2) 1.7 x 10-1 microns mole Ca/ml of reaction medium; and (3) 3.3 x 10-2 microns moles Zn/ml of reaction medium. In the presence of alpha-ketoglutaric acid, none of the metals had such a severe effect. However, 1.7 microns moles of Mn/ml of reaction medium inhibited oxygen uptake in the presence of both substrates. Cadmium and Zinc were found to increase the huldelysis of adapting tripher-photo by the the hydrolysis of adenosinetriphosphate by the mitochondria to a greater extent than either manganese or calcium. Previous investigators had speculated that deaths in fishes exposed to varying levels of lead, zinc, mercury, and copper were caused by coagulation or precipitation of mucus secreted by the gills, or damage to gill tissues. Research conducted here indicated that these effects may have been only secondary, and that the primary cause at death may be attributed to loss of energy production systems within the cells. (Lowry-Texas) W71-08955

#### TOLERANCE TO DISSOLVED NITROGEN, New Mexico State Univ., University Park

R. E. Speece, and W. E. Leyendecker. New Mexico State University, Engineering Experiment Station, Technical Report, No 59, Nov 1969. 43 p, 7 fig, 11 tab, 7 ref, 2 append. OWRR Project A-018-NMEX (1).

Descriptors: \*Fishkills, \*Nitrogen, Pressurc, \*Trout, Saturation, Respiration, Aeration, Fish hatchery, Temperature, Chlorine, Dissolved oxygen, Oxygenation, Metabolism, Toxicity, Dininfection, Chromatography, Monitoring, Mixing, Fry, Water pollution effects, \*Lethal limit. Identifiers: \*Goldfish, Dissolved nitrogen.

The tolerance to dissolved nitrogen of trout fingerlings and goldfish was compared in both pressurized and non-pressurized systems. The effect of the dissolved nitrogen on the rate of respiration of the fingerlings was also determined. Dissolved nitrogen concentrations as low as 100% of saturation caused trout fingerling mortality in the pressure system. This phenomenon was interesting since many well-aerated trout streams have 100% saturation concentrations of dissolved nitrogen. However, large numbers of bubbles were found on the specimens and the walls of the holding troughs, and it was speculalated that these bubbles were quite possibly the cause of the mortality. Both goldfish and trout lost equilibrium in the pressure system, but the goldfish floated and survived while trout died. Trout fingerlings were unable to tolerate 105% of dissolved nitrogen saturation for more than 4 1/2 days, while goldfish survived saturation concentrations of 140% for 48 hours, and 105% for concentrations of 140% for 40 nours, and 100 concentrations of 140% for 40 nours, and 100 concentrations as high as 140% for 48 hours but in pressure systems, they lost equilibrium at 100% of dissolved nitrogen saturation in less than an hour. (Lowry-Texas) W71-08960

## EFFECT OF WATER TEMPERATURE ON NYMPHAL FEEDING RATE, EMERGENCE, AND ADULT LONGEVITY OF THE STONEFLY PTEROMARCYS DORSATA, Environmental Protection Agency, Duluth, Minn.

National Water Quality Lab.

Alan V. Nebeker.

Journal of the Kansas Entomological Society Vol 44, No 1, p 21-26, Jan 1971. EPA Program 18050 WAA 01/71.

Descriptors: \*Water temperature, \*Feeding rates, \*Stoneflies, \*Temperature, Water pollution effects, Insects, \*Insect behavior, \*Aquatic insects. Identifiers: Pteronarcys dorsata.

The optimum and limiting temperatures for nymphal feeding, longevity of adults, number of eggs produced, and success of adult emergence were determined for the stonefly Pteronareys dorsata Newman (Pteronarcidae, Ptecoptera). The highest feeding rate occurred at 20°C. No feeding occurred at 1°C or 35°C. The adults that emerged at occurred at 1C or 35C. The adults that emerged at 10C lived twice as long as those that emerged at 20C. None emerged at 5C or 25C. The best egg production occurred at 15C. The average adult life span was 17.5 days from nymphs reared at 20C, 31 days from nymphs held at 15C, and 36 days from larvae reared at 10C. (See also W71-08978) (Ncbeker-EPA) W71-08977

## EFFECT OF TEMPERATURE AT DIFFERENT ALTITUDES ON THE EMERGENCE OF AQUATIC INSECTS FROM A SINGLE STREAM,

Environmental Protection Agency, Duluth, Minn. National Water Quality Lab.

Alan V. Nebeker.

Journal of the Kansas Entomological Society Vol 44, No 1, p 26-35, Jan 1971. EPA Program 18050-

Descriptors: \*Water temperature, \*Insect behavior, \*Stoneflies, Seasonal distribution, Altitude, \*Temperature, Water pollution effects, \*Aquatic insects, Insects. Identifiers: Plecoptera.

An analysis was made of the effects of temperature as influenced by altitude on the seasonal distribution and adult emergence of all winter stoneflies (Plecoptera) in a single stream. Water temperature of the stream, when modified by air temperature, solar insolation, snow cover, and springs produced significant changes in insect emergence patterns. (See also W71-08977) (Nebeker-EPA)

RADIOACTIVE DEBRIS FROM UNDERGROUND NUCLEAR EXPLOSIONS. 1. PHYSICAL AND CHEMICAL CHARACTERISTICS. 2. BIOLOGICAL AVAILABILITY OF THE RADIONUCLIDES TO AQUATIC ANIMALS.

California Univ., Berkeley. Lawrence Radiation

Florence L. Harrison.

Available from the National Technical Information Service as UCRL-50596, \$3.00 in paper copy, \$0.95 in microfiche. Report UCRL-50596, Feb 7, 1969. 28 p.

Descriptors: \*Marine animals, \*Radionuclides, Descriptors: "Marine animais, "Radionucinos, "Nuclear explosions, Absorption, Aquatic animals, Particle size, Suspension, Adsorption, Metabolism, Aquaria, Water pollution effects, Zinc radioisotopes, Leaching.

Identifiers: Cerium radioisotopes, radioisotopes, Manganese radioisotopes, Ruthemi-um radioisotopes, Zirconium radioisotopes, Antimony radioisotopes.

Aquatic animals can become contaminated by uptake of dissolved radionuclides or by radionuclides present in small partices that have been taken up by the animals. Radioactive debris from the chimney area of two contained underground nuclear exploarea of two contained underground nuclear explosions was characterized as to particle size, radionuclide concentration, leachability, and uptake in edible parts of freshwater and marine animals. Leachability of the debris radionuclides was determined in distilled water, synthetic pond water, synthetic sea water, and I molar ammonium acetate. Untake by reshwater animals was rapid acetate. Uptake by reshwater animals was rapid with Ce, Mn, Ru, Zn, and Zr; slow with Co, Cs, and Sb. Uptake by marine animals was rapid with Ce, Sb. Uptake by marine animals was rapid with Ce, Cs, Mn, Ru, and Zr; slow with Co, Sb, and Zn. Since the animals were exposed to the radionuclides for only short periods of time (1-3 weeks), the equilibrium uptake was probably not attained. Uptake was higher by freshwater than marine animals for Zn-65, but lower for Cs-137. (Bopp-NSIC) W71-09004

#### STUDIES ON ZINC IN FRESHWATER ECOSYSTEMS,

Oberlin Coll., Ohio. Edward J. Kormondy. Available from the National Technical Information Service as COO-1499-3, \$3.00 in paper copy, \$0.95 in microfiche. Report COO-1499-3, Jan 1969. 32 p. Contract AT (11-1)-1499.

Descriptors: \*Zinc radioisotopes, \*Aquatic insects, \*Aquatic plants, Aquatic environment, Ecosystems, Aquatic habitats, Dragonflies, Algae, Sediments, Soil-Water-Plant relationships, Nuclear wastes, Absorption, Chelation, Metabolism, Aquaria, Water pollution effects, Adsorption.

Zinc-65 is significantly concentrated in the aquatic environment from nuclear wastes. The present experiments with microcosms (dragonfly larvae, algae, water, and soil) show a dependence of uptake on temperature, volume of the aquarium and light; which suggests that metabolic activity plays a role. In particular, uptake by aquatic plants was affected by photosynthesis. Only about 1% as much uptake by plants occurred in the presence of the chelating agent EDTA. Preliminary studies showed varia-tions in chelation by soil between various soil types. The binding of zinc by soil was reduced by the presence of plants. (Bopp-NSIC) W71-09005 BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES, ATLANTIC-PACIFIC INTEROCEANIC CANAL, BIBLIOG-

RAPHY,
Battelle Memorial Inst., Columbus, Ohio.
A. W. Rudolph, T. E. Carroll, R. S. Davidson, and

Available from the National Technical Information Service as BMI-171-41, \$3.00 in paper copy, \$0.95 in microfiche. Report BMI-171-41, June 30, 1970.

Descriptors: \*Bibliographies, \*Nuclear explosions, \*Environmental effects, Excavation, Canal construction, Radioactivity effects, Radioisotopes, Absorption, Food chain, Rain forests, Aquatic life, Marine animals, Marine fish, Crop production, Panama Canal.

This bibliographic compilation has been prepared in support of two related research programs: bioenvironmental and radiological-safety feasibility studies, Atlantic-Pacific interoceanic canal; and the possible effects of a sca level canal on the marine ecology of the American Isthmian region. Some of the major topics are, broadly stated: human, agricultural, forest, freshwater and marine ecology; and hydrological transfer processes. Abstracts are of the indicative type, intended to describe the content with details. Index terms are listed immediately following the abstract. (See also W71-099007 thru W71-09010) (Bopp-ORNL) W71-09006

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES, ATLANTIC-PACIFIC INTEROCEANIC CANAL, POSSIBLE EFFECTS OF A SEA-LEVEL CANAL ON THE MARINE ECOLOGY OF THE AMERICAN ISTHMIAN REGION, ABSTRACTS, THESAU-

Battelle Memorial Inst., Columbus, Ohio.

Thomas E. Carroll, and Ann W. Rudoph.

Available from the National Technical Information Available from the National Technical Information Service as BMI-171-25 and BMI-171-42, \$3.00 each in paper copy, \$0.95 each in microfiche. Abstracts, Report BMI-171-25, July 22, 1969. 275 p; Thesaurus, Report BMI-171-42, June 30, 1970. 129 p. Contract AT (26-1)-171.

Descriptors: \*Marine fish, \*Ecological distribution, \*Canal Zone, Fish populations, Aquatic habitats, Marine fisheries, Oceanography, Tropical regions, Atlantic Ocean, Pacific Ocean, Canals, Ecology, Ecosystems, Mathematical models, Documentation, Abstracts.

These two reports consist of a compilation of 674 documents and a thesaurus, respectively. The compilation was made in support of the title research program, and an index to the abstracts was to be program, and an index to the abstracts was to be published as a third report. The major topics of the abstracts are: geological history of the isthmian re-gion, flora and fauna of the eastern tropical Pacific gion, nora and tauna of the eastern tropical Factic and western Caribbean, physical and chemical occanography of the isthmian region, present and potential fisheries, marine biology and ecology, mathematical modeling, distribution of species, life history information, and population dynamics. (See also W71-09006) (Bopp-NSIC) W71-09007

## MATHEMATICAL METHODS FOR EVALUATING THE TRANSPORT AND ACCUMULATION OF RADIONUCLIDES, Battelle Memorial Inst., Columbus, Ohio.

For primary bibliographic entry see Field 05B.

#### DARIEN FISH POLYCLAVE.

Battelle Memorial Inst., Columbus, Ohio.

J. A. Duke.

Available from the National Technical Information Service as BMI-171-34, \$3.00 in paper copy, \$0.95 in microfiche. Report BMI-171-34, Mar 12, 1970. 60 p. Contract AT (26-1)-171.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5C—Effects of Pollution**

Descriptors: \*Nuclear explosions, \*Canals, \*Marine fish, \*Ecological distribution, Salinity, Descriptors: Turbidity, Resistance, Atlantic Ocean, Pacific Ocean, Feasibility studies, Information retrieval, Aquatic habitats.

An ecological study was conducted in connection with feasibility studies for the proposed sea-level canal. An information-retrieval system is presented for economically important fish species. It is predicted which species of fish are more likely to cross the canal and which are more likely to find a niche in the Atlantic. The species which show a wide range of tolerance of habitats, salinities, and turbidity are more likely to cross a canal. (See also W71-09006) (Bopp-NSIC) W71-09009

## DARIAN PHYTOSOCIOLOGICAL DICTIONA-

Battelle Memorial Inst., Columbus, Ohio. For primary bibliographic entry see Field 02I. W71-09010

#### RADIONUCLIDE CYCLING IN AQUATIC ECOSYSTEMS.

Oak Ridge National Lab., Tenn. Evelyn Brown, J. R. Gammon, and N. A. Griffith. Available from the National Technical Information Service as ORNL-4446, \$3.00 in paper copy, \$0.95 in microfiche. Report ORNL-4446, p 113-136, July

Descriptors: \*Radioisotopes, \*Absorption, \*Aquatic plants, \*Aquatic animals, Lakes, Labora-Descriptors: radioisotopes, Aerobic bacteria.

Identifiers: Tungsten radioisotopes, Cesium radioisotopes, Sulfur radioisotopes, Manganese radioisotopes

Laboratory studies in conjunction with field work on White Oak Lake provided data for predictive models. The topics discussed include: pathway descriptions, turnover rates, uptake from various foods. Data are included on: uptake of W-181 from water by black bullheads and crayfish; cycling of Co-60, Cs-137, Mn-54, Sr-85, and Zn-65 in aquatic plants; uptake of Fe-59, W-181, and Zn-65 in the newt; the role of aerobic bacteria in the cycling of S-35; kinetics of Co-60, Cs-137, and K-42 in microcosms; and uptake of Cs-137 in seven species of fish. (See also W71-09012) (Bopp-ORNL) W71-09011

## HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1969: SYSTEMS ECOLOGY, WATERSHED AQUATIC HABITAT INTERAC-TIONS

Oak Ridge National Lab., Tenn.

Available from the National Technical Information Service as ORNL-4446, \$3.00 in paper copy, \$0.95 in microfiche. Report ORNL-4446, (p 137-162), July 1969.

Descriptors: \*Ecology, \*Mathematical models, \*Watershed management, Geochemistry, Lakes, Coniferous forests, Algae, Insects, Phosphorus radioisotopes, Technology, Natural resources, Ecological distribution, Stochastic processes, Ecosystems, Aquatic habitats, Water pollution effects.

The purpose of the ecological systems analysis program is to develop a methodology for making useful predictions about the outcome of environmental interactions. Progress is reported on the following projects: pertience of recent ecological literato the modeling of ecosystems, biogeochemical ecology research collection, parameter identification in systems ecology, numerical methods in systems ecology, a versatile compartment system simulation program, a stochastic model of feeding in a forest centipede, a model for cedar bog lake (Minnesota), analysis of the change-in-ratio model for estimating population abundance, and systems analysis of balsam forests. The Walker Branch watershed project was organized to assess the potential ecological impact of new technology being applied to the field of natural resource management. A compartment model is illustrated for evaluation of transfer rates and characteristics of the transfer functions among the principal components of the watershed ecosystem. A material balance study using P-32 and periphytic algae in a closed system in the laboratory was conducted to obtain data on uptake and turnover of phosphorus by stream diatoms. (See also W71-09011) (Bopp-NSIC) W71-09012

## RADIOLOGICAL PHYSICS DIVISION. AN-NUAL REPORT, JULY 1968-JUNE 1969. Argonne National Lab., Ill.

For primary bibliographic entry see Field 05G. W71-09013

COLUMBIA RIVER STUDIES. ANNUAL PROGRESS REPORT, 1968-1969,
Washington Univ., Seattle. Lab. of Radiation

Ecology. For primary bibliographic entry see Field 05G. W71-09014

#### COLORADO TROUT LAKE STUDIES (NEW STUDIES ON EXPERIMENTAL CONTAMINA-TION OF MARINE SPECIES BY CS-137, RU-106, AND CE-144),

Colorado State Dept. of Natural Resources, Fort Collins. Div. of Game, Fish and Parks. C. A. Barnes.

Available from the National Technical Information Service as TID-25342, \$3.00 in paper copy, \$0.95 in microfiche. Report TID-25342, Jan 20, 1970. 12

Descriptors: \*Freshwater fish, \*Fallout, \*Food chains, Public health, Radioactivity effects, Water pollution effects, Fishing, Lake fisheries, Mountains, Alpine, Size.
Identifiers: \*Cesium radioisotopes, Ruthenium

radioisotopes, Cerium radioisotopes.

It is concluded that in the event of renewed contamination of the environment by radioactive fallout, the larger fish from montane and alpine lakes would present the greatest potential health hazard if caught and consumed by fisherman. Results of measurements of Cs-137 contamination of fish caught in three lakes are given. (Bopp-NSIC)

#### RADIOECOLOGICAL STUDIES ON THE COLUMBIA RIVER. PART I.

Battelle Northwest, Richland, Wash. Pacific Northwest Lab.

For primary bibliographic entry see Field 05B. W71-09017

#### STUDY OF THE MANGANESE CYCLE IN FRENCH WATERS AND IN BRINE USING MN-

Aix-Marseille Univ. (France).

D. Asselin-Bagarry.

Available from the National Technical Information Service as NP-18395, \$3.00 in paper copy, \$0.95 in microfiche. Report NP-18395, Jun 1970. 199 p.

\*Radioisotopes, Descriptors: \*Aquatic life, \*Sediments, Water pollution effects, Cycling nutrients, Trace elements, Radioecology, Salinity, Aquatic plants, Fish, Mollusks, Water pollution sources. Identifiers: \*Manganese radioisotopes.

Stages of manganese-54 in the food web were studied including: uptake by sediments, uptake by plants taking root in the sediment, uptake by crustaceans eating the plants, and uptake by fish eating the plants. Uptake by two species of aquatic plants reached saturation in ten days. Concentration factors were 30,000 to 80,000. Desorption in pure water occurred in two stages with periods of 1.5 and 17.5 days. Uptake by fish reached saturation in 9 days in fresh water; in 13 days in saline water. The slower desorption period was 47 days in fresh water; 63 days in saline water. (Bopp-NSIC) W71-09019

# RADIATION EXPOSURE TO MAN FROM DISPOSAL OF TRITIATED WATER VAPOR TO

THE ATMOSPHERE,
Commissariat a l'Energie Atomique, Fontenayaux-Roses (France). Centre d'Etudes Nucleaires.
Jacques Planet, Guy Uzzan, and Jacques Le Grand.
Available from the National Technical Information Service as CEA-CONF-1560, \$3.00 in paper copy, \$0.95 in microfiche. Report CEA-CONF-1560, 1970. 25 p. (Presented at the 2nd Congress of the International Radiation Protection Association, Brighton, England).

Descriptors: \*Human population, \*Milk, \*Tritium, Radioactivity effects, Absorption, Nuclear wastes, Air pollution effects, Water pollution sources, Water pollution effects, Food chains, Soil contamination, Precipitation (Atmospheric).

The dispersion of tritiated water in the physical environment (dispersion in air, rainwater contamination, and ground contamination) is examined. Both contamination by inhalation of tritiated water vapor and ingestion of foods (drinking water, vegetables, and animal products) are considered. The method is applied to a plant, 3 km from a village, discharging tritiated steam through a stack. The yearly dose as a function of age of individuals is estimated. The study showed that in certain cases the dose through ingestion of milk is appreciable for infants. (Bopp-NSIC) W71-09020

## CYCLE OF ORGANIC MATTER IN THE SEA.

Woods Hole Oceanographic Institution, Mass. J. H. Ryther, and D. W. Menzel.

Available from the National Technical Information Service as NYO-3862-31, \$3.00 in paper copy, \$0.95 in microfiche. Report NYO-3862-31, May 1, 1970.48 p.

\*Phytoplankton, \*Productivity, Descriptors: \*Cycling nutrients, Trace elements, Nutrient requirements, Phytotoxicity, Decomposing organic matter, Sedimentation, Benthic fauna, Oceanography, Pollutant identification, Marine animals, Ecosystems, Food webs.

Cycling of organic matter through the marine ecosystem is being studied. Topics included are: the effect of growth-inhibiting or -stimulating trace elements on phytoplankton, loss of organic matter by excretion, effects of excretion and decomposition of plants and animals on nutrition of benthic fauna, and pathways of penetration of particulate organic matter to the sea floor. Analysis of data obtained on the first of two cruises is nearly complete. Publications are listed. (Bopp-ORNL) W71-09021

#### ECOLOGY OF PODON POLYPHEMOIDES (CRUSTACEA, BRANCHIPODA) IN THE CHES-APEAKE BAY,

Johns Hopkins Univ. Baltimore, Md. Chesapeake

Bay Inst. 'H. F. Bosch, and W. R. Taylor.

Available from the National Technical Information Service as NYO-3497-23, \$3.00 in paper copy, \$0.95 in microfiche. Report NYO-3497-23, May 1970. 77 p.

#### Effects of Pollution—Group 5C

Descriptors: \*Crustaceans, \*Plankton, \*Ecology, Tributaries, Biorhythms, Period of growth, Size, Gradation, Verticle migration, Water pollution effects.

Identifiers: Chesapeake Bay.

This species appears in the plankton in shallow tributaries during the spring, declines during the summer, resurges in autumn, and disappears during winter. Overwintering eggs hatch prior to both spring and fall peaks. The mid-bay population attains greatest densities within 11-26C, 8-18% salinity, and greater than 2 ml/l of oxygen. Concentiations of the salinity and greater than 2 ml/l of oxygen. trations are situated in the upper layers during the day, and in deeper water at night. (Bopp-ORNL) W71-09022

BIBLIOGRAPHIC DISCUSSION ON PHYSICO-CHEMICAL BEHAVIOR AND THE RADIOECOLOGY IN HYDROBIOLOGICAL SYSTEMS OF CERIUM AND OTHER LANTHANIDES, (IN FRENCH),

Commissariat a l'Energie Atomique, Fontenayaux-Roses (France).

Robert Bittel.

Available from the Nationl Technical Information Service as CEA-Bib-138, \$3.00 in paper copy, \$0.95 in microfiche. Report CEA-Bib-138, May 1969, 88 p.

Descriptors: \*Hydrologic properties, \*Biological properties, \*Physicochemical properties, Chelation, Chemical reactions, Soil chemical properties, Water pollution effects, Radioecology, Effluents. Identifiers: \*Lanthanides, Rare earths, Cerium addioiectors Properties, Properties and Properties Pr radioisotopes, Promethium radioisotopes, Europium radioisotopes.

Concerns lanthanides with a long or medium half life (cerium, promethium, and europium); complexes of these elements with compounds present in effluents and contaminated aqueous environments; analytical techniques used in radio- and tracer chemistry; and behavior of rare earths (principally cerium) in soils. (Bopp-NSIC) W71-09023

## ACCUMULATION OF RADIONUCLIDES IN FISH, (IN GERMAN), Staatliche Zentrale fuer Strahlenschutz, Berlin

(East Germany). E. Ettenhuber.

Available from the National Technical Information Service as SZS-7/70, \$3.00 in paper copy, \$0.95 in microfiche. Report SZS-7/70, Apr 1970. 30 p.

Descriptors: \*Radioisotopes, \*Absorption, \*Fish, Public health, Water pollution effects, Environmental effects, Bibliographies, Reviews.

The effect of environmental parameters on uptake of radionuclides by fish is reviewed briefly and public health aspects are considered. Concentration factors are tabulated for uptake of a number of radionuclides by different species of fish. (Bopp-W71-09024

# A PRELIMINARY BIBLIOGRAPHY OF MATHEMATICAL MODELING IN ECOLOGY, Oak Ridge National Lab., Tenn. R. V. O'Neill, J. M. Hett, and N. F. Sollins.

Available from the National Technical Information Service as ORNL-IBP-70-3, \$3.00 in paper copy, \$0.95 in microfiche. Report ORNL-IBP-70-3, Oct

Descriptors: \*Mathematical models, \*Bibliographies, \*Ecology, Documentation, Ecosystems, Primary productivity, Plant populations, Dominant organisms, Plant growth substances, Ecological distribution, Systematics, Secondary productivity, Animal populations, Decomposing organic matter, Ecosystem, Aquatic environment, Cycling nutrients, Drainage, Soil-water-plant relationships, Speciation, Information retrieval, Simulation analvsis, Optimization.

The techniques of mathematical modeling are expected to play a major role in the synthesis of data from the Deciduous Forest Biome Project. It was necessary to limit the scope of the bibliography in order to make it available as early in the program as possible. No attempt was made to review developments in systems analysis which have been reported in engineering or operations research journals. Also, no attempt was made to present the many kenetics models found in the physiological literature. Finally, the literature on the applications of statistics in ecology has been reviewed recently (Schultz, 1961) and these citations have been omitted. Instructions for preparing citations in a standard punch-card format are given in an appendix. (Bopp-NSIC) W71-09025

## AN INTRODUCTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS IN ECOSYSTEM MODELS,

Oak Ridge National Lab., Tenn.

R. V. O'Neill.

Available from the National Technical Information Service as ORNL-IBP-70-4, \$3.00 in paper copy, \$0.95 in microfiche. ORNL-IBP-70-4, Dec. 1970. 29 p, 1 fig, 9 tab, 9 ref.

Descriptors: \*Mathematical models, \*Ecology, \*Numerical analysis, Linear programming, Approximation method, Energy equation, Regression

Identifiers: Differential equations.

Four of the available numerical solution methods for differential equations are evaluated relative to their potential use in ecosystem models. A simplified energy flow model is used as an example. The Runge-Kutta method consistently emerged as reliable and efficient. Although the Euler method is simple, the user should be aware of the notential pitfalls which are associated with it. Use of a variable rather than a fixed value of the calculation interval h can greatly increase efficiency, and derivation of methods specifically designed for a particular problem can improve accuracy. Such refinements will be discussed in a future publication. (Bopp-NSIC) W71-09026

## HEATED EFFLUENT - AN ASSET TO

AGRICULTURE, Washington State Office of Nuclear Energy Development, Seattle.

L. B. Bradley.

Power Engineering, Vol. 73, No. 3, p. 52-62, March 1969.

Descriptors: \*Beneficial use, \*Thermal pollution, \*Power plants, \*State governments, resources development, Planning, Agriculture, Effluent irrigation water, Economic feasibility, Columbia River, Oregon, Washington.

Can warm water from power plants be used for large-scale irrigation. The states of Washington and Oregon are trying to find out. These states will get their answers from a cooperative bi-state program, now underway. Essentially, the program has two parts: One is an irrigation experiment to determine the feasibility of using warm water. The second project is a multiple-use study to formulate an integrated water resource-agriculture-power generation system. The intent is to deliberately integrate the interests of water resource conservationists, the agricultural community and the power-producing entities. The goal is multiple usage of waters to serve the needs of all with minimum penalty to any. Both analytic and experimental approaches will be used, along with large-scale field research. (Houser-NSIC) W71-09028

**HYPERPLASIA** ESTUARINE BRYOZOAN ATTRIBUTABLE TO COAL TAR DERIVATIVES,

National Museum of Natural Sciences, Ottawa (Ontario); and Washington State Shellfish Lab.,

Willapa Bay, Wash.
N. A. Powell, C. S. Sayce, and D. F. Tufts.
Journal of the Fisheries Research Board of Canada, Vol. 27, No. 11, p 2095-2098, 1970. 3 fig. 3 ref.

Descriptors: \*Pathology, \*Water pollution effects, \*Coal tar coating, \*Oily water, \*Creosote, Oil, Oil wastes, Wood preservatives (Pesticides), Asphalt, Construction materials, Washington. Identifiers: \*Hyperplasia, \*Bryozoans, Tumors, Invertebrate pathology, Carcinogens, Schizoporella sp., Willapa Bay.

Hyperplasia of bryozoan (Schizoporella unicornis) ovicells was noted in portions of Willapa Bay, Washington, where petroleum derivatives were in evidence. In one location, creosote, gasoline, and diesel and engine oil were present, while in another, asphalt-coated creosote was in use. Normal bryozoan colonies were transferred to these areas, and abnormalities occurred within 7-9 days. The authors suggest that this organism might be useful in monitoring estuarine waters for oil pollution. (LeGore-Washington) W71-09036

#### THE TOXICITY OF FOUR INSECTICIDES TO FOUR SALMONID SPECIES,

Colorado State Univ., Fort Collins. George Post, and Thomas R. Schroeder. Bulletin of Environmental Contamination and Toxicology, Vol. 6, No. 2, p 144-155, 1971. 6 tab, 12 ref. Funded by Bur. of Sport Fishery and Wildlife, Fish Pesticide Research Lab. contract.

Descriptors: \*DDT, \*Endrin, \*Carbamate pesticides, \*Organophosphorous pesticides, \*Chlorinated hydrocarbon pesticides, \*Lethal limit, \*Salmon, \*Trout, Insecticides, Bioassy, Pesticide toxicity, Fishkill, Mortality, Salmonids, Fish diseases, Fish physiology, Fish toxins, Toxicity. Identifiers: \*Malathion, \*Carbaryl, TL-m, Salvelinus sp., Salmo sp., Oncorhynchus sp., Water pollution effects. pollution effects.

A study was conducted to determine the relative toxicity of four commonly used insecticides (DDT, endrin, carbaryl and malathion) to four salmonid fishes commonly used for experimentation. Standard static bioassay procedures were followed. Ninety-six hour TL-m values differ from those in previously published literature. This, it is concluded, is related to any of several variables, e.g. body weight, water quality, fish strain and physical factors. Susceptibility to the various pesticides was definitely species or strain dependent. Carbaryl was generally the least toxic of the four insecticides. (LcGore-Washington) W71-09037

#### EFFECT OF PINE LITTER ON QUALITY OF WATER RECEIVED BY SMALL FISHING IM-POUNDMENTS,

Arizona Univ., Tucson. Arizona Cooperative Fishery Unit.

William Seawell, George Adams, and William J. McConnell.

Journal of the Arizona Academy of Sciences, Vol. 5, No. 4, p 263-270, 1969. 2 fig, 6 tab, 20 ref.

Descriptors: Water pollution effects, \*Ponderosa pine trees, \*Small watersheds, \*Runoff, \*Leaching, Water quality, Arizona, Temperature, Phenols, Color, Chemical oxygen demand, Carbohydrates, Detritus, Decomposing organic matter. Identifiers: \*Pine litter, \*Pine needles, Rose Canyon Lake (Ariz).

From the evidence presented, it does not appear that the organic compounds leached from the Ponderosa Pine needles commonly have a conspicuously beneficial (e.g. trophic) or detrimental

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects of Pollution

(e.g. oxygen demand, toxicity) effect on the animal community of small water impoundments. This does not, however, rule out the low level, chronic toxicity produced by tanning and/or by related phenolic compounds. Light reduction due to litterstrained runoff may limit primary productivity, which may in turn affect fish production. (Wahtola-Washington) W71-09038

TOXICITY TESTS WITH OIL DISPERSANTS IN CONNECTION WITH OIL SPILL AT CHEDABUCTO BAY, NOVA SCOTIA, Fisheries Research Board of Canada, St. Andrews

(New Brunswick). Biological Station.

John B. Sprague, and William G. Carson.

Fisheries Research Board of Canada, Technical Report No. 201, 1970. 30 p. 5 fig, 2 tab, 4 ref.

Descriptors: \*Oily water, \*Bioassay, \*Lethal limit, \*Emulsions, \*Emulsifiers, \*Toxicity, \*Detergents, \*Water pollution effects, Oil, Oil wastes, Dispersion, Colloids, Bioindicators, Mortality, Pollution abatement, Water pollution control, Toxins, Non-structural alternatives, Water treatment, Lobsters,

Identifiers: \*Oil pollution, \*Bunker oil, \*Corexit 8666, BP 1002, Flounder, Pseudopleuronectes sp., Homarus sp., Salmo sp.

The authors report the results of preliminary screening of several Bunker C oil dispersants for acute toxicity to small salmon (Salmo salar) in fresh water and to winter flounder (Pseudopleuronectes americanus) and lobsters (Homarus americanus) in sea water. Dispersants tested in static bioassays included Corexit 8666, BP 1100B, BP 1100, BP 1002, Gulf Agent 1009, naphtha gas, Dispersant 88, Dispersol SD and XZIT x-1-11. Corexit 8666 appeared to be the least toxic to all organisms, but it is cautioned that an apparent toxicity during degradation should be investigated before this compound is recommended for wide scale use. Five appendices supply detailed test data, holding conditions for test animals, a discussion of toxic degradation products of Corexit 8666, notes on autopsies, and notes on the appearance of test mixtures. (LeGore-Washington) W71-09039

#### A REVIEW OF POSSIBLE CAUSES OF MOR-TALITY OF OYSTER LARVAE OF THE GENUS CRASSOSTREA IN TOMALES BAY, CALIFOR-NIA,

University of the Pacific, Dillon Beach, Calif. Pacific Marine Station.

Carl J. Berg, Jr.

California Fish and Game, Vol. 57, No. 1, p. 69-75, 1971, 35 ref.

Descriptors: \*Larvae, \*Oysters, \*Turbidity, \*Sediments, \*Mortality, \*Food abundance, Life cycles, Mollusks, Temperature, Salinity, Hydrogen ion concentration, Silts, Organic compounds, Trophic level, Dinoflagellates, Red tide, Diseases, Water pollution effects, California.

Identifiers: Setting, \*Spatfall, Cultch, Sedimentation, Spat, Tomales Bay (Calif).

The inability of oysters (Crassostrea sp.) to produce successive generations in Tomales Bay can be attributed to failure of larval survival and set, since the adults do spawn. No single factor is held accountable for the absence of oysters spat. Lack of proper food and nutrients probably is a very important factor. In Tomales Bay, extreme turbidity is responsible for larval loss because all possible places where oyster larvae may settle are soon covered with a layer of mud. Blooms of dinoflagellates are the third major cause of larval mortality. Other causes are not likely to be as important as these three, but they do contribute to generally unfavorable conditions for oyster larvae in this bay. (LeGore-Washington) W71-09041

THE EFFECTS OF OIL POLLUTION AND CLEANING ON SALT MARSH ECOLOGY, Field Studies Council, Pembroke (England). Oil

Pollution Research Unit.

J. M. Baker.

Field Studies Council, Oil Pollution Research Unit, Orielton Field Centre, Annual Report, 1969, p 3-26. 16 fig, 18 ref.

Descriptors: \*Oil, \*Oily water, \*Emulsions, \*Emulsifiers, \*Toxicity, \*Water pollution treatment, Water pollution effects, \*Salt marshes, \*Tidal marshes, \*Coastal marshes, \*Marsh plants, \*Resistance, Oil wastes, Bioassay, Dispersion, Bioin-dicators, Detergents, Mortality, Pollution abate-ment, Pathology, Path of pollutants. Identifiers: \*Oil pollution, \*Oil spills, \*Chronic

pollution, Spartina sp., Recovery.

The author concisely summarizes two years of investigation of the effects of oil pollution, both acute and chronic, on salt marsh plants. Effects and phytopathological mechanisms of emulsifiers in general are discussed. It is concluded that salt marshes are quite resistant to isolated incidents, relative to permanent damage, but that chronic oil pollution can kill all vegetation. The degree of recovery ability, however, is not definitively known. It is recommended that oiled salt marshes should be left untreated, at least until more effica-cious methods are available. (LeGore-Washington) W71-09043

#### THE BIOLOGICAL EFFECTS OF MARINE OIL POLLUTION AND SHORE CLEANSING,

Field Studies Council, Pembroke (England). Oil Pollution Research Unit.

Geoffrey B. Crapp.

Field Studies Council, Oil pollution Research Unit, Orielton Field Centre, Annual Report, 1969, p 27-42. 9 fig, 15 ref.

Descriptors: \*Oil, \*Oily water, \*Emulsifiers, \*Toxicity, \*Water pollution treatment, Water pollution effects, \*Snails, \*Mussels, Oil wastes, Bioassay, Emulsions, Dispersion, Bioindicators, Detergents, Mortality, Resistance, Mollusks, Intertidal areas, Shores, Shore protection.

Identifiers: \*Oil pollution, \*Chronic pollution, \*Oil spills, \*Barnacles, Repopulation, Recovery, Limpets, Rocky shores.

This report summarizes results in in situ experimentation concerning effects of oil, primarily Kuwait crude and Kuwait atmospheric residue, on shore life, especially barnacles and mollusks. Treatment of shore plots with the emulsifier, BP 1002, was concurrently studied. Laboratory bioassays challanging limpets, mussels and snails with graded concentrations of emulsifiers are also discussed.
Recovery of Hazelbeach and Llanreath shores following detergent-cleaning is described, as are ecological effects of oil spillage and of chronic pollution by refinery effluents. (LeGore-Washington) W71-09044

## MICRO-RESPIROMETRY AND EMULSIFIER TOXICITY, University Coll. of Swansea (Wales).

A. Nelson-Smith.

Field Studies Council, Oil Pollution Research Unit, Orielton Field Centre, Annual Report, 1969, p 43-47. 2 fig, 5 ref.

Descriptors: \*Bioassay, \*Emulsifiers, \*Toxicity, \*Water pollution treatment, \*Water pollution ef-fects, \*Enzymes, \*Inhibitors, \*Analytical fects. techniques, Emulsions, Bioindicators, Detergents, Resistance, Pollutant identification, Respiration. \*Oil Identifiers: pollution, Respirometer. Microrespirometer.

The Gilson microrespirometer (a Warburg respirometer refinement) was used in an attempt to devise a rapid method of comparing emulsifier toxicities and in a preliminary investigation of the effects of emulsifiers on some enzymes of the tricar-

boxylic-acid cycle. Emulsifers were tested against boxylic-acid cycle. Emulsifers were tested against standard suspensions of baking yeast. Commercial quality BP 1002 depressed oxygen uptake to a greater degree than did BP 1002 in an experimental, more aliphatic solvent (Blend Y). BP 1100 appeared even less toxic. Crab muscle succinic dehydrogenase and oxoglutarate dehydrogenase were greatly inhibited by BP 1002, while no change in fumarase activity was noted. Isocitric dehydrogenase was unaffected. (LeGore-Washington) ton) W71-09045

EFFECTS OF PESTICIDES ON EMBRYONIC DEVELOPMENT OF CLAMS AND OYSTERS AND ON SURVIVAL AND GROWTH OF THE

Bureau of Commerical Fisheries, Milford, Conn; and Maryland Univ., Solomons. Natural Resources

Harry C. Davis, and Herbert Hidu. U. S. Fish and Wildlife Service, Fishery Bulletin, Vol 67, No 2, p 393-404, 1969. 1 fig, 2 tab, 11 ref.

Descriptors: \*Pesticides, \*Insecticides, \*Herbicides, \*Nematocides, \*Bactericides, \*Fungicides, \*Algicides, Water pollution effects, Lethal limit, \*Pesticide toxicity, Bioassay, \*Clams, \*Oysters, \*Growth rates, Pesticide drift, Toxicity, Mollusks, Mortality, Embryonic growth stage.

Identifiers: Survival, Growth, \*Embryonic development, Morphological effects, Embryo, Develop-ment, Morphology (Animal), Mercenaria sp., Cras-

Fifty-two compounds were tested for their effects on embryos of the hard clam, Mercenaria mercenaria, and of the American oyster, Crassostrea virginica, and on their larvae. The pesticides included 17 insecticides, 12 herbicides, one nematocide, four solvents, and 18 miscellaneous bactericides, fungicides and algicides. Most of the com-pounds affected normality of embryonic develop-ment more than survival or growth of larvae. Some, however, drastically reduced growth of larvae at concentrations that had relatively little effect on embryonic development. It is necessary, therefore, to evaluate the effects of pesticides on all stages of the life cycle of an organism before the pesticide can be considered safe. Nevertheless, differences in toxicity to bivalve larvae among the compounds of each category of pesticide are large enough that it should be possible to select compounds to control pest species without serious damage to commercial shellfish. (LeGore-Washington) W71-09047

#### DYNAMICS OF MS-222 IN THE BLOOD AND BRAIN OF FRESHWATER FISHES DURING ANETHESIA.

Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.

Joseph B. Hunn.

U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Investigations in Fish Control series, No 42, 1970. 11 p, 3 tab, 11 ref.

Descriptors: \*Fish physiology, \*Path of pollutants, Water pollution effects, \*Fish control agents, \*Fish management, \*Absorption, Analytical technoies, Bioassay, Colorimetry, Color reactions, Laboratory tests, Fish farming, Fish handling facilities, Fresh-

water fish, Pathology.
Identifiers: Fish handling, MS-222, \*Anesthetics, Fish anesthetics, Drugs, Nervous tissue, Brain tis-

Eleven species of freshwater fishes were rapidly anethetized in solutions of MS-222 (methanesulfonate of meta-aminobenzoic acid ethyl ester) containing 100-1,000 mg of MS-222 per liter. MS-222 concentrations in blood and brain after one minute exposure indicate that MS-222 rapidly diffuses across the gill and passes the blood-brain barrier. Acetylated MS-222 was detected in the blood of all species studied, indicating that the drug is metabolized. The concentration of free MS-222 in the brain increased with depth of anesthesia to loss of reflex and then either increased or declined slightly as the fish approached medullary collapse. (LeGore-Washington) W71-09049

**EFFECT OF MS-222 ON ELECTROLYTE AND** WATER CONTENT IN THE BRAIN OF RAIN-BOW TROUT,

Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab. Wayne A. Willford.

U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Investigations in Fish Control Series, No 43, 1970. 7 p, 2 tab, 21 ref.

Descriptors: \*Fish physiology, \*Electrolytes, \*Sodium, \*Potassium, \*Calcium, \*Magnesium, \*Iron, \*Fish control agents, \*Fish management, \*Rainbow trout, Diffusion, Ions, Bioassay, Water pollution effects, Fish farming, Fish handling facilities, Pathology, Trout.
Identifiers: \*MS-222,

Identifiers: \*MS-222, \*Anesthetics, \*Fish anesthetics, \*Zinc, Drugs, Nervous tissue, Brain tissue, Electrolytic imbalance, Fish handling.

Rainbow trout (Salmo gairdneri) were exposed to 100 mg/l solutions of the anesthetic, MS-222 (methanesulfonate of meta-aminobenzoic acid ethyl ester) for 1-, 2-, 4- and 10-minute intervals and their brains were analyzed for sodium, potassium, calcium, magnesium, zinc, iron and water content. The mean potassium content decreased 17.7 % and iron increased 56.2% during 2-minute exposures. Sodium and calcium increased slightly (7.4 and 9.4%); magnesium, zinc and water content remained relatively constant. All of the affected electrolytes returned toward control values with 4and 10-minute exposures. These shifts in electrolytes appear to be related to depth of anesthesia and to the concentrations of free MS-222 in the brain. (LeGore-Washington) W71-09050

Lake Powell Quality Studies for the Navajo Plant, Bechtel Inc., San Francisco, Calif; and Arizona State Univ., Tempe.

H. S. Riesbol, W. L. Minckley, and R. F. Kilmartin.
Paper, American Society of Civil Engineers, National Water Resources Engineers Meeting, Phoenix, Ariz, Jan 1971. 59 p, 11 fig, 3 tab, 30 ref,

Descriptors: \*Water quality, Water pollution, \*Salinity, Lakes, Fish, Investigations, Aquatic life, Limnology, Hydrology, Climatology, Water temperature, Air temperature, Bibliographies, Inflow, \*Dissolved solids, Reservoir operation, Stratified flow, Public opinion.

Identifiers: Lake Powell, Navajo Powerplant, Ariz, Colorado River.

Water quality investigations were made at Lake Powell to provide the basis for design of cooling water facilities for the Navajo steam electric generating station. The Navajo station cooling towers would have a total waterflow of 1,620,000 gal/min with an annual makeup requirement of 34,000 acre-ft at an average rate of 50 cfs. Under the scheme considered, 4,500 acre-ft of blowdown water would be discharged annually from the cooling towers at an average rate of 6 cfs after 6 concentrations. The investigation was to determine what adverse effects the blowdown water would have on the aquatic environment of Lake Powell if the blowdown water were returned to the lake with no additional treatment. Although the study indicated no adverse effects of such an arrangement, objections were raised to even nominal increases in salinity by downstream interests and water quality control agencies. The report contains water quality studies focused primarily on the lower 15 mi of the lake, but necessarily includes an overall view of the lake behavior. (USBR) W71-09051

PERSISTENT PESTICIDES IN THE ENVIRON-

MENT, Rothamsted Experimental Station, Harpenden

For primary bibliographic entry see Field 05B. W71-09088

ENVIRONMENTAL MERCURY RESEARCH IN

Swedish Environment Protection Board. Stockholm.

For primary bibliographic entry see Field 05B. W71-09089

RESIDUES OF TOTAL MERCURY AND METHYLMERCURIC SALTS IN LAKE TROUT AS A FUNCTION OF AGE, Cornell Univ., Ithaca, N.Y. Pesticide Residue Lab. C.A. Bache, W. H. Gutenmann, and D. J. Lisk. Science, Vol 172 No 3986, p 951-952, May 28, 1971 2-159 1 1971. 2 p, 1 fig, 1 tab, 7 ref.

Descriptors: \*Lake trout, \*Heavy metals, \*Poisons, \*Metal organic pesticides, Water pollution sources, Aquatic life, Environmental effects, Trout, Freshwater fish, New York, Water pollution effects. Identifiers: \*Heavy metal poisons, \*Mercury, Cayuga Lake (N.Y.).

To relate mercury concentrations to time of exposure of fish, an analysis of the concentration of total mercury and methylmercuric salts in lake trout of precisely known ages from 1 to 12 years has been carried out. Trout from Cayuga Lake, Ithaca, New York, which are tagged and stocked annually as fingerlings, were netted in October 1970 to obtain samples of as many different ages as possible. Mercury can reach the lake from its use in laboratory research, in dental and medical services, in agriculture, in coal burnt in powerplants, and from other sources. The concentrations of both total mercury and methylmercury were found to increase with age of the fish but were not related to the fish sex. total mercury and methylmercury in the fish by age and the percentage of total mercury that was present as methylmercury. (Lang-USGS) W71-09104 A data table presents a list of concentrations of

#### EUTROPHICATION OF SHELTERED BAYS IN A LARGE LAKE,

Utah State Univ., Logan. Center for Water Resources Research.

William T. Helm.

Available from the National Technical Information Service as PB-200 259, \$3.00 in paper copy, \$0.95 in microfiche. Center for Water Resources Research, Utah State University, Final Report (undated). 53 p, 6 fig, 5 tab, 55 ref. OWRR Project B-010-UTAH (1).

Descriptors: \*Eutrophication, \*Lakes, \*Bays, Circulation, Distribution, Particle size, Invertebrates, Currents (Water), Nutrients, Oxygen, Respiration, Biological communities, Clays, Environment, Silts. Biological community,
Organic matter, Diptera.
\*Sheltered

bays, Tanytarsus, Polypedilum, Tendipes, Ordination analysis.

Objectives of this investigation were to determine the quantity and quality of influent in bays or breakwater areas of Bear Lake, Utah-Idaho, and to appraise biological responses to water quality of the bays. Three partially completed studies dis-closed the importance of the median grain size of sediments, contents of silt and clay and organic matter, the velocity of currents, and concentration of oxygen near the bottom. The results were sub-jected to ordination analyses. The structure of communities was influenced by environmental conditions. The median grain size of 0.20 mm is of critical importance for the distribution of benthic invertebrates. The continuum of some chironomids was indicative of the community type and environment. Only three species of chironomids, Tanytar-sus A, Polypedilum digitifer, and Tendipes, were

present in numbers sufficient to be utilized in production studies. The density of Tanytarsus was indirectly related to silt and clay and organic matter content of the bottom. (Wilde-Wisconsin) W71-09150

## LIMNOLOGY OF LAKE CHAMPLAIN: 1965-

Vermont Univ., Burlington. Dept. of Zoology For primary bibliographic entry see Field 02H.

## **OXYGEN PRODUCTION IN SOME NORTHERN**

INDIANA LAKES,
Manchester Coll., North Manchester, Ind. Dept. of

Biology.
William R. Eberly.
Proceedings of the Industrial Waste Conference
17, p 733-747, 1963. 5 fig, 6 tab, 3 ref.

Descriptors: \*Oxygen, \*Indiana, \*Lakes, \*Dissolved oxygen, Hypolimnion, Biota, Productivity, Measurement, Metabolism, Profiles, Stratification, Seasonal, Oligotrophy, Eutrophication, Nutrients, Seasonal, Ongotrophy, Eutrophication, Nutrients, Temperature, Photosynthesis, Diffusion, Respiration, Decomposing organic matter, Light, Turbulence, Epilimnion, Thermocline, Winds, Solar radiation, Carbon dioxide, Hydrogen ion concentration

Identifiers: \*Oxygen production, Orthograde oxygen curves, Myers Lake (Ind), McLish Lake (Ind), Taylor Lake (Ind), Meso-orthograde, Plusheterograde, Meso-clinograde, Clinograde oxygen curves, Mesotrophic, Metalimnion, Morphometry.

An oxygen profile, depicting vertical distribution of dissolved oxygen, is a significant diagnosis of lake character; profiles indicating lake metabolisms strikingly develop during summer stratification, showing lake differences. Orthograde, mesoorthograde, clinograde, meso-clinograde, and plus-heterograde oxygen curves are described. Temperature and light affect oxygen concentration in the greatest variety of ways. Stratification may develop with a warm surface layer overlying the cold bottom layer, the plane of maximum temperature change being the thermocline; oxygen below the epilimnion may accumulate to high concentrations. Transparency of a lake is both cause and effect of its particular productivity pattern. In addition to plankton concentration, transparency varies with turbidity and color. Relation of transparency and production in different lake types is expressed graphically and mathematically. Oxygen production curves are given for three lakes. Some anomalous results indicate that Oscillatoria agardhii may subsist in absence of visible light (or at extremely low intensities) by some chemosynthetic process, perhaps releasing free oxygen. Since Oscillatoria utilizes sulfates, possibly a sulfate deficiency is a limiting factor in production of a deep-water oxygen maximum produced by Oscillatoria. (Jones-Wisconsin) W71-09153

#### JAMES RIVER-WILSON CREEK STUDY SPRINGFIELD, MISSOURI.

Federal Water Pollution Control Admin., Robert S. Kerr Water Research Center, Ada, Okla.

Vol 1, June 1969. 60 p, 14 fig, 2 tab, 23 ref.

Descriptors: \*Water pollution effects, \*Water pollution control, \*Water pollution sources, \*Fishkill, Storm runoff, Odor, Subsurface runoff, Ground-Limestones, Infiltration, movement, Domestic wastes, Benthic fauna, Industrial wastes, Drainage, Aquifers, Sinks, Cities, Sewage treatment, Sewers, Aeration, Monitoring, Landfills, Biochemical oxygen demand, Chemical oxygen de-

Identifiers: \*Urban storm runoff, James River (Mo), Wilson Creek (Mo), Springfield (Mo), Sewage plant bypasses.

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C-Effects of Pollution

Fish kills, associated with storm runoff, and odorous and unsightly conditions in Wilson Creek which flows past Springfield (Mo) and the Wilson's Creek Battlefield National Park prompted investigation. Thunderstorms caused Wilson Creek to dominate flow at point of confluence with the James River. Since the area is underlain with limestone, significant volumes of surface and waste water enter the upper groundwater aquifers through numerous sinkholes and crevices, some of which are in the Wilson Creek bed. This water, passing through a maze of fractures and solution channels in the limestone, often reappears in degraded condition. Possible pollution causes were sewage treatment plant bypasses (especially following rains), scouring of sludge deposits, industrial waste discharges, storm runoff from Springfield, and slugs of poor quality subsurface water from Rader Spring entering surface waters. Recommendations are storm runoff control, sewage treatment plant improvement, improvement of industrial waste treatment facilities, effort to restore Rader Spring to high quality, attempt to preclude pollution of groundwater aquifers, construction of a reservoir on the James River for flow augmentation, and establishment of a monitoring system. History, description of problems and discussion are included. (Jones-Wisconsin) W71-09154

#### SHORELINE ALGAE OF WESTERN LAKE ERIE.

Ohio State Univ., Columbus. Graduate Studies in

Botany. Rachel Cox Downing

The Ohio Journal of Science, Vol 70, No 5, p 257-276, 1970. 97 fig, 37 ref.

Descriptors: \*Lake shores, \*Algae, \*Lake Erie, Aquatic habitats, Lakes, Aquatic environment. Identifiers: \*Algal species, Western Lake Erie, Arnoldiella conchophila Miller.

In spite of some 70 year investigations of algae inhabiting western Lake Erie, almost nothing was known prior to this study of the shoreline as a specific habitat of these organisms. This site harbors 61 taxa, 39 of which are new records for this part of the lake, and one, Arnoldiella conchophila Miller, was previously reported only from central Russia. (Wilde-Wisconsin)
W71-09156

### FUTURE PROSPECTS OF ALGAE AND MAN.

Vermont Univ., Burlington. Dept. of Botany. Richard M. Klein.

Annals New York Academy of Sciences, Vol 175, p 778-781, 1970. 9 ref.

Descriptors: \*Algae, \*Human population, Fertilizers, Diatomaceous earth, Food chains, Oxygen, Ecology, Rhodophyta, Phaeophyta, Chlorella, Plant pathology, Industries, Ions, Cyanophyta, Radioisotopes, Temperature, Ecosystems, California, Irrigation, Economic feasibility, Water pollution cantel. California Arisma. tion control, California, Arizona.

Identifiers: Fodder, Glue, Agar, Polysiphonia, Antibiotics, Iodine, Atomic energy, Reactor cooling, Imperial Valley (Calif), Los Angeles (Calif), Tucson (Ariz).

Economic criteria of how and where algae can be used to serve man's biological, physical, and esthetic needs is considered. Although the acknowledged base of all food chains and the primary source for most of the earth's oxygen, the economic potential of algae has barely been explored. The larger red and brown algae are increasingly needed for fertilizers and fodder; antibiotics are derived from Chlorella, Polysiphonia, and other species; iodine has been obtained by burning marine algae. The potentials of utilizing the ability of algae to concentrate mineral ions hundreds of times the concentration in water, the control of speciation and its effect on pollution, possible utilization of blue-green algal parasites for increasing concentration of nitrates and phosphates suffi-

ciently that algae may be harvested for commercial usage; use of halophytic algae in lowering excessive concentration of sodium chloride in drinking water. The qualitative and quantitative alteration in spectrum of algae species as the result of atomic energy plant operations and their effects on man are unknown, particularly whether algae will accu-mulate radioactive ions effectively. Algal tox-onomists, algal physiologists, and algal histochemists must consider themselves ecologists and pool their knowledge to contribute to humani-ty's welfare. (Auen-Wisconsin) W71-09157

## DISTRIBUTION AND ABUNDANCE OF TU-BIFICID (OLIGOCHAETA) SPECIES TORONTO HARBOUR, LAKE ONTARIO, Toronto Univ. (Ontario). Dept. of Zoology.

R. O. Brinkhurst.

Journal Fisheries Research Board of Canada, Vol 27, No 11, p 1961-1969, 1970. 7 fig, 3 tab, 8 ref.

Descriptors: \*Distribution, \*Tubificids, \*Oligochaetes, \*Lake Ontario, Population, Har-\*Tubificids, bors, Water pollution effects, Coliforms, Biochemical oxygen demand, Dissolved oxygen, Lake Superior, Indicators, Biomass, Nitrogen, Phosphorus, Industries, Water pollution sources, Sediments. Identifiers: \*Toronto Harbor (Canada), Lake Ontario (Canada), River mouth, Detroit River (Ontario-Mich), Don River (Ontario), Tubifex tubifex, Limnodrilus hoffmeisteri, Peloscolex multisetosus, Aulodrilus pluriseta, Potamothrix vejdovskyi, Potamothrix hammoniensis.

Dry weight values, identity, and abundance of tubificid species in Toronto Harbor were determined. The tubificid oligochaetes build up populations in excess of 200,000 per square meter. At the mouth of the Don River, an abundance of pollution-tolerant species are located, whereas small numbers and some less pollution-tolerant species are found near the island shores. No evidence of diurnal rhythms in the vertical distribution of the worms in sediment was found. That the tubificids can be used as indicators of organic pollution is confirmed by this survey, but relative abundance of worms and other benthic organisms, as well as relative profusion of the worm species themselves, rather than the mere presence of certain species, demands attention. Tubifex tubifex and Limnodrilus hoffmeisteri in great abundance and in the absence of other benthic organisms indicate gross organic pollution, as evident in Toronto Harbor and in the Don River where they constitute the entire benthos. Dry weights for tubificids are about 16% of wet weight for fresh-starved worms. Ash content averaged 34% of dry weight for worms with gut full of mud, but 11% for worms clear of gut contents. (Jones-Wisconsin) W71-09159

#### THE FATTY ACID COMPOSITION OF TWO MARINE FILTER-FEEDERS IN RELATION TO

A PHYTOPLANKTON DIET,
National Inst. of Oceanography, Wormley (England). F. Culkin, and R. J. Morris.

Deep-Sea Research, Vol 17, No 5, p 861-865,

1970. 2 tab, 14 ref.

Descriptors: \*Lipids, \*Marine animals, \*Diets. Phytoplankton, Diatoms, Gas chromatography, Atlantic Ocean, Zooplankton.

Identifiers: Tunicates, Fatty acids, Filter-feeders, Pyrosoma, Salpa cylindrica, Polyunsaturated acids, North Atlantic, Chemical composition.

The fatty acids of two tunicate filter-feeders, Pyrosoma (Peron) and Salpa cylindrica Cuvier, which feed directly on phytoplankton, were analyzed. Sufficiently large quantities for fatty acid analyses of phytoplankton from the same region could not be collected thus the known major features of phytoplankton fatty acid composition were used for comparison. Plant fatty acids differ from those of zooplankton. The stage in the food chain at which this modification of the phytoplankton fatty acid pattern takes place is not clear. The two species of tunicate were found to be very similar in fatty acid composition (examined by gas-liquid chromatography) and, qualitatively, to other zooplankton. However, the levels of myristic acid were considerably higher than those found in other zooplankton examined in this study, which is consistent with a phytoplankton diet. In common with phytoplankton, the tunicates were found to contain a high proportion (13x9% and 12x6% of total acids respectively) of myristic acid (14:0). Their principal polyunsaturated acid was 22.6 omega 3 and the polyunsaturated acids of the carbon-16 series, whih are usually present in phytoplankton, were not detected. (Jones-Wisconsin) W71-09160

#### MERCURY--MAJOR NEW ENVIRONMENTAL PROBLEM,

New York State Dept. of Environmental Conservation, Albany. Bureau of Fish. For primary bibliographic entry see Field 05B. W71-09164

#### ON THE GROSS AND NET PRODUCTION OF PERIPHYTON AND PLANKTON ALGAE, (IN RUSSIAN),

Irkutskii Gosudarstvenyi Universitet (SSSR). O. M. Kozhova.

Doklady Akademii nauk SSSR, Vol 195, No 4, p 965-968, 1970. 3 tab, 5 ref.

Descriptors: \*Periphyton, \*Plankton, \*Productivity, Photosynthesis, Biomass, Oxygen, Algae, Comparative productivity, Eutrophication.
Identifiers: Bratsk Reservoir (Siberia), Angara

River (Siberia).

This study of the Bratsk Basin included determinations of photosynthesis of periphyton by light and dark bottles, and production of phytoplankton by the Vinberg oxygen method. The reported results present averages for vegetation seasons of 1964 and 1967 for phytoplankton, and of 1965, 1967, and 1968 for periphyton. The phytoplankton consisted largely of Melosira, Stephanodiscus, Asterionella, and Cryptomonadacea sp in the spring, and of Aphanizomenon and Ceratium sp in summer. The predominant members of periphyton included Cladophora, Ulothrix, Oedogonium, Spirogyra, and Mougeotia sp. The diurnal gross and net production of periphytonic algae was 44.2 and 33.8 mg oxygen per g of fresh weight, respectively. The production to biomass ratio (P/B coefficient) of phytoplankton, recalculated on carbon, was appreciably higher than that of the periphyton. (Wilde-Wisconsin) W71-09165

#### LOCALIZATION OF DDT IN THE BODY OR-GANS OF PINK AND WHITE SHRIMP.

Bureau of Commercial Fisheries, Gulf Breeze, Fla. Center for Estuarine and Menhaden Research. D. R. Nimmo, A. J. Wilson, Jr., and R. R.

Bulletin of Environmental Contamination and Toxicology, Vol 5, No 4, p 333-341, 1970. 7 tab, 3 ref.

Descriptors: \*DDT, \*Shrimp, \*Pesticides, Pesticide residues, Laboratory tests, Water pollution ef-

fects, Marine animals.
Identifiers: \*Body organs, \*Penaeus duorarum,
\*Penaeus setiferus, DDD, DDE, Hepatopancreas.

Shrimp were exposed to low concentrations of DDT in the laboratory for extended periods to compare the residues accumulated under controlled conditions with residues in natural populations. After being subjected to selected concentra-tions, the amount and rate of accumulation, the lethal concentration, and the amount of DDT accumulated in individual organs were determined. All shrimp exposed to 0.2 ppb DDT died within 18 days and all shrimp exposed to 0.12 ppb died within 28 days. Analysis of organs confirmed that DDT

was concentrated in the hepatopancreas. Findings show that the magnitude of contamination in some of the field samples approached that of treated shrimp. Analysis of shrimp from field collections confirmed the laboratory observations that DDT was localized in the hepatopancreas; this organ is discarded when the animals are processed as food for human consumption. The edible tail muscle had the least residue—well below that considered hazardous to human health. The survival of penaeid shrimp would be threatened if relatively high amounts of DDT reached the shrimp nursery areas in estuaries and remained relatively constant. (Jones-Wisconsin) W71-09167

INITIAL UPTAKE, DISTRIBUTION AND LOSS OF SOLUBLE Ru-106 IN MARINE AND FRESH-WATER ORGANISMS IN LABORATORY CON-DITIONS,

Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium). Dept. of Radiobiology.

O. van der Borght, and S. van Puymbroeck.

Health Physics, Vol 19 (Dec), p 801-811, 1970. 10 fig, 4 tab, 15 ref.

\*Distribution, Descriptors: \*Absorption, \*Radioisotopes, \*Marine animals, \*Marine plants, Aquatic animals, Laboratory tests, Nitrates, Mus-Relation and the self-state of the self, Nitrates, Mussels, Snails, Fish, Algae, Gastropods, Adsorption, Temperature, Metabolism, Kinetics, Water pollution effects, Nuclear wastes.

Identifiers: Ruthenium, Fixation, Tissues, Alburnus

lucidus, Belgium.

wastes from nuclear reprocessing plants, ruthenium-106 is apparently the most important radioisotope contaminating algae and fish. This investigation was conducted to understand the factors, such as environmental conditions, and physicochemical state of ruthenium on the radioactive contamination of organisms, and the early kinetics of fixation, distribution and release of soluble ruthenium orginating from nitrate nitrosyl complexes by some marine and freshwater organisms. The early uptake, distribution and loss by mussels, snails, fish, algae, and two gastropods of ruthenium-106 were studied for short periods under laboratory conditions. Initial uptake and distribution of ruthenium-106 is similar in the marine and freshwater lamellibranch (Mytilus and Anodonta), but fixation is much higher in the freshwater snail, Viviparus, than in the fish, Alburnus. In the radiocontamination of organisms by soluble ruthenium, thin structures, such as byssus, in direct contact with water, show high ruthenium content, indicating the important role of surface adsorption. Temperature-dependance suggests metabolic interference, although temperature-dependance and general kinetics of the uptake are similar both in algae and in animals studied. Slower uptake of isotopes at lower temperatures indicates the advisability to release radioactive wastes during periods of low metabolic activity. (Jones-Wisconsin) W71-09168

# CONTEMPORANEOUS DISEQUILIBRIUM, A NEW HYPOTHESIS TO EXPLAIN THE 'PARADOX OF THE PLANKTON', California Univ., Davis. Dept. of Zoology; and California Univ., Davis. Inst. of Ecology.

Peter Richerson, Richard Armstrong, and Charles

R. Goldman. Proceedings of the National Academy of Sciences,

Vol 67, No 4, p 1710-1714, 1970. 2 fig, 1 tab, 10

Descriptors: \*Phytoplankton, \*Lakes, Epilimnion, Zooplankton, Distribution, Primary productivity, Algae, Biomass, Oligotrophy, Diatoms, Euglena, Daphnia, Habitats, Niches, Competition, California

Identifiers: \*Contemporaneous disequilibrium, Lake Tahoe (Calif), Castle Lake (Calif), Diversity, Patches.

Unexpectedly high diversity found in even small samples of lake phytoplankton has been termed 'the paradox of the plankton.' A small volume of water, for example 10 ml, usually shows some tens water, for example 10 mi, usually snows some tensof species where the competitive exclusion principle might lead to expectation of only one or a few
species. Patches of water may exist in which one
species competes advantageously relative to the
others. They are stable enough for considerable
patchiness among phytoplankton, but are
obliterated frequently enough to prevent exclusive occupation of each niche by a single species. With epilimnion mixing, only one or at most, a few niches for primary producers might be expected. In samples from Castle Lake, California, a high degree of patchiness for many phytoplankton species was found indicating mixing that is efficiently cies was found, indicating mixing rate is sufficiently slow in relation to the algal productivity rate, for many different niches to exist simultaneously. In Lake Tahoe, productivity per unit biomass ratios show that turnover times for carbon are often less than one day. High diversity is associated with high productivity per unit biomass and high zooplankton model is a plausible explanation of the diversity.
(Jones-Wisconsin)

PHOTOSYNTHESIS IN THE ALGAE, Brandeis Univ., Waltham, Mass. Dept. of Biology. Martin Gibbs, Erwin Latzko, Michael J. Harvey, Zvi Plaut, and Y. Shain. Annals New York Academy of Sciences, Vol 175, p 541-554, 1970. 5 fig, 6 tab, 40 ref.

Descriptors: \*Biochemistry, \*Photosynthesis, \*A!gae, Phylogeny, Carbon cycle, Enzymes, Metabolism, Hydrogen, Euglena, Chlorella, Scenedesmus, ism, hydrogen, Euglena, Chiorena, Sceneuesmus, Chlamydomonas, Cyanophyta, Chlorophyta, Ox-ygen, Light, Chrysophyta, Ochromonas, Respira-tion, Chlorophyll, Carbon radioisotopes, Carbon dioxide, Rhodophyta. Identifiers: Warburg effect, Euglena graclis, Calvin cycle, Anacystis nidulans.

The photosynthetic carbon reduction cycle in algae is discussed from evidence described in the literature; this cycle is now firmly established. Twelve enzymically catalyzed steps are involved. At least ribulose 1,5-diP carboxylase and fructose 1,6-diphosphatase are involved in carbon dioxide fixation. The bulk of the evidence suggests that the carbon reduction cycle is the major pathway for the entry of photosynthetically assimilated carbon dioxide in the majority of chlorophyllous algae. On the basis of present knowledge of photosynthetic carbon assimilation in algae, the autotrophic phase ceases with the light-catalyzed conversion of car-bon dioxide into fructose 6-P and glucose 6P. The heterotrophic phase commences with their conversion into other cellular components, sometimes referred to as secondary products. Important evidence for metabolic regulation of the photosynthetic carbon reduction cycle in algae indicates the cycle is not isolated from the rest of the cell metabolism. Assessment of the true value of these results was hindered by possible interchange of intermediates common to both photosynthesis and respiration. Successful isolation of algal chloroplasts from the giant cell of Acetabularia mediterranea, able to carry out normal photosynthesis, was recently accomplished. (Jones-Wisconsin)

HYPNODINIUM-LIKE ALGAL BLOOMS IN GEORGIA LAKES,

Georgia State Univ., Atlanta. Dept. of Biology; and Georgia Water Quality Control Board, Atlanta.

D. G. Ahearn, Edward T. Hall, Jr., and Donald J. Reinhardt.

BioScience, (Research Reports), p 115, February 1, 1971. 1 fig, 1 ref.

Descriptors: \*Algae, \*Lakes, \*Georgia, Sewage effluents, Water pollution effects, Water pollution sources, Eutrophication, Coliforms, Spores, Life cycles, Odor, Recreation, Systematics.

Identifiers: \*White algal blooms, Hypnodinium, Lake Sidney Lanier (Georgia), Lake Jackson (Georgia), Lake Cardinal (Georgia), Lake Buckhorn (Georgia).

Lakes on different river systems in northwest Georgia produced a white algal bloom of varying intensity in June, lasting 7-10 days. At its peak, dense surface flocs were found where sewage effluents were received, in all the 1970 bloom sites. Prior to, during the state of the s ing, and after the bloom, hydrographic conditions in the Flat Creek area of Lake Lanier were monitored with observations on thermocline, temperature, pH, dissolved oxygen. Four days prior to the appearance of the bloom, the fecal coliform density appearance of the bloom, the recar contoins understy increased from less than 4/100 ml to more than 240/100 ml. The milky white surface scum from all lakes was composed of bodies surrounded with a clear envelope containing large protoplasmic bodies. A dark protoplastic body matured into a dark macrospore which subdivided producing 2 to dark macrospore which subdivided producing 2 to 15 or more bi-pored microspores. No exit of protoplasmic bodies through the pores was observed, although bi-flagellated zoospores occurred in large numbers in the microscope preparations. The bi-pored cells of this alga make it distinct from Hypnodinium sphaericum Klebs. It has not been directly associated with fish kills. A disagreeable odor accompanies the bloom and the thick surface flocs interfere with recreation. (Jones-Wisconsin) W71.00173 W71-09173

# BIOLOGICAL EVALUATION OF ENVIRON-MENTAL QUALITY, GREEN BAY, LAKE MICHIGAN,

Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.

R. P. Howmiller, and A. M. Beeton.

Journal Water Pollution Control Federation, Vol
43, No 1, p 123-133, 1971. 8 fig, 2 tab, 18 ref.

Descriptors: \*Evaluation, \*Biological communi-Descriptors: \*Evaluation, \*Biological communi-ties, \*Oligochaetes, Water pollution sources, En-vironment, Water pollution effects, Sampling, Eutrophication, Benthic fauna, Nematodes, Am-phipoda, Clams, Isopods, Snails, Midges, Caddis-flies, Tubificids, Lake Michigan, Mayflies, Inver-tebrates, Diptera, Larvae, Wisconsin. Identifiers: \*Green Bay (Wis), Fox River (Wis), Lumbriculidae, Naididae, Leeches, Hexagenia, Snhaeriidae.

Sphaeriidae.

Benthos of lower and middle Green Bay (Wisconsin) were sampled in May 1969 to correspond with the same date 17 years earlier, using the same sta-tions and nearly identical equipment in an attempt to eliminate discrepancies due to different apparatus, methodology and season of past studies. In 1952 Oligochaeta accounted for an average of 66% of the benthic organisms from Stations 2 to 10; in 1969 an average of 85%. Leeches were less abundant and less widely distributed in 1969 than in 1952. Snails occurred at ten stations in 1952 but at two in 1969. Fingernail clams were less abundant in 1969 than in 1952. While no naiad clams were re-ported in 1952, Lampsilis siliquoidea was found at Station 15 in 1969. The distribution of amphipods, similar in 1952 and 1969, showed more abundance and comprised a larger population percentage in 1952; Hexagenia has disappeared. The midges, pollution tolerant second only to Oligochaeta, decreased near Fox River mounth, increased north of Lon Tail Point, but decreased in relative importance. Thus benethic invertebrates, other than Oligochaeta and Chironomidae, were less abundant in 1969 than 1952 suggesting that the deterioration of the bay environment is continuing. (Jones-Wisconsin) W71-09174

PRODUCTION, MINERAL NUTRIENT AB-SORPTION, AND BIOCHEMICAL ASSIMILA-TION BY JUSTICIA AMERICANA AND ALTER-NANTHERA PHILOXEROIDES,

Auburn Univ., Ala. Agricultural Experiment Sta-

Claude E. Boyd. Archiv fur Hydrobiologie, Vol 66, No 2, p 139-160, 1969. 3 fig, 14 tab, 23 ref.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5C—Effects of Pollution**

Descriptors: \*Aquatic plants, \*Productivity, \*Nutrients, \*Absorption, Biochemistry, Seasonal, Inorganic compounds, Storage, Phytoplankton, Amino acids, Organic compounds, Cellulose, Proteins, Standing crop, Phosphorus, Alligatorweed, Chemical analysis, Nitrogen, Alkalinity, Cattalle Pondweeds

tails, Pondweeds.
Identifiers: \*Biochemical assimilation, \*Justicia americana, \*Alternanthera philoxeroides, Mineral nutrients, Lake Ogletree (Ala), Lake Seminole (Fla), Angiosperms, Nutrient storage, Caloric content, Dry matter production.

Aquatic angiosperms probably play an important role in biogeochemical cycles of many lakes. Comprehensive studies were made to determine the amounts of nutrients bound in lake vascular flora, amounts of interest sound in late vascular incla-evaluating production, mineral absorption, and biochemical assimilation for stands of Justicia americana (L) Vahl and some comparative data obtained for alligator weed, Alternanthera philoxe-roides (Mart) Griseb. Both species are emergent roides (Mart) Griseb. Both species are emergent perennial herbs, frequently occurring in extensive, relatively monospecific, stands in shallow water areas. Net dry matter production in a Justicia americana stand was complete by mid-July. During late May and early June, maximum rate of net productivity occurred with percentage composition of most chemical constituents declining steadily as the growing season progressed. The maximum absorption rate of mobile mineral nutrients occurred prior to maximum growth. The greatest quantity of these nutrients was absorbed early and then utilized for subsequent growth. Net production of several biochemical constituents was complete by mid-June. Alternanthera philoxeroides behaved June. Alternanthera philoxeroides behaved similarly. Lentic J americana stands had higher dry matter standing crops than lotic stands. There was a relation between water hardness and chemical composition of various stands. (Jones-Wisconsin)

A PLASTIC BARRIER FOR SPOT TREATMENT OF AQUATIC VEGETATION, Texas Parks and Wildlife Dept., Waco. R. L. White, and R. L. Bounds. The Progressive Fish-Culturist, p 57-59, January

Descriptors: \*Aquatic plants, \*Herbicides, \*Treatment, Diffusion, Barriers, Chemcontrol, Texas,

Fishing, Recreation.
Identifiers: Myriophyllum brasiliense, Najas guadalupensis, Polyethylene sheeting, Aquathol Plus, Lake Inks (Tex), Lake Lyndon B Johnson (Tex).

Central Texas Highland lakes are most conducive to aquatic vegetation growth, impeding recreational fishing. Complete lake treatment was cost prohibitive and spot treatment by liquid and pel-leted chemicals proved ineffective due to dilution. A barrier of polyethylene sheeting, to prevent dilu-tion through wave action, was tested on sites ranging from 0.25 acre to 1.00 acre; the chemical used s Aquathol Plus. Barriers were attached to old was Aquation rules below the bottom for stability. Where rock bottoms prevented installation of rods, styrofoam blocks raised the sheeting. Except where a barrier was destroyed by wind or inundation, the plots were cleared of vegetation for a minimum of three months; eleven sites showed no regrowth six months after treatment. Vegetation outside the plots showed little or no effect from chemical diffusion through the sheeting. Some fish became entangled, but the barriers were not damaged. A treatment rate of 1.00 ppm with a 36-hour use of the barrier was most effective. Sites were treated early in the spring and vegetation control continued into late fall when cooler temperatures inhibited regrowth. (Jones-Wisconsin)

# COEFFICIENTS OF ACCUMULATION OF THE RADIOISOTOPE IRON-59 BY CERTAIN SPECIES OF FRESH WATER PLANTS,

Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany. N. I. Matulyavichene.

Radiobiology, Vol 10, No 3, p 461-463, May-June 1970. 1 fig, 2 tab, 6 ref. AEC-tr-7193 from Radiobiologiya.

Descriptors: \*Aquatic plants, \*Radioisotope, \*Absorption, Iron, Fresh water, Chara, Water pollution

Identifiers: \*Iron radioisotopes.

The effect of environmental factors on the uptake of iron-59 from water by aquatic plants was stu-died. Uptake was 12 -75% higher from natural lake water in an aquarium as compared with water which simulated the chemical composition of the lake water, but did not contain the suspended organic and inorganic material that was present in the lake water. A change in pH from 5.3 to 8.9 decreased uptake from 30 to 37 %. (Bopp-NSIC)

## BOMB CARBON-14 IN DEEP SEA ORGAN-

California Univ., San Diego; and Washington

For primary bibliographic entry see Field 05B. W71-09181

INITIAL UPTAKE, DISTRIBUTION AND LOSS OF SOLUBLE RUTHENIUM-106 IN MARINE AND FRESHWATER ORGANISMS IN LABORA-

Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium). Dept. of Radiobiology.
O. Van der Borght, and S. Van Puymbroeck.
Health Physics, Vol. 19, p 801-811, Dec. 1970.

Descriptors: \*Radioisotopes, \*Marine animals, \*Absorption, Aquaria, Mollusks, Snails, Mussels, Marine algae, Aquatic animals, Fresh water, Freshwater fish, Temperature, Kinetics, Nuclear wastes, Solubility, Adsorption, Water pollution effects, Food chains.
Identifiers: \*Ruthenium radioisotopes.

Ruthenium uptake extending to long-term equilibria were studied since this element is often the limiting factor in the disposal of wastes from nuclear reprocessing plants. The general kinetics including the temperature dependence were similar for four marine organisms (an alga, a mussel, and two snails); and the initial uptake was similar for marine and freshwater mussels. A relatively high concentration in thin organs in direct contact with the water suggested that surface absorption plays a role. Release of wastes during periods of low temperature (winter) will minimize biological concentration before dilution in the biosphere. (Bopp-NSIC) W71-09182

## RADIOACTIVE POLLUTION OF RIVERS IN

CZECHOSLOVAKIA, Ustav Hygieny, Prague (Czechoslovakia). For primary bibliographic entry see Field 05B. W71-09183

STUDY OF THE PHYSICAL CHEMISTRY OF RUTHENIUM IN SEA WATER, (IN FRENCH), Commissariat a l'Energie Atomique, La Hague (France).

For primary bibliographic entry see Field 05B. W71-09184

## RADIATION ECOLOGY STUDIES, PROGRESS REPORT, JAN. 1968-JAN. 1969,

Emory Univ., Atlanta, Ga.

Robert B. Platt.

Available from the National Technical Information Service as ORO-2412-16, \$3.00 in paper copy, \$0.95 in microfiche. Report ORO-2412-16, 1969. 48 p.

Descriptors: \*Radioecology, \*Soil-water-plant relationships, \*Radioactivity effects, Estuarine environment, Fungi, Isopods, Ecosystems, Ecology, Drainage patterns.

The report is divided into five subprojects: (1) Studies of the ecology of Panola Mountain included determination of soil moisture content, soil composition, and radionuclide content of plants. A map was prepared to show distribution of major soil islands, forested communities, and drainage patterns across the granite outcrop. (2) Investigations were conducted on the fungal ecology of the granite outcrops, and (3) the effect of microweathering of the granite on plant growth. (4) Gamma irradiation of wheat seed and (5) osmoregulation in intramarsupial and newly-shed young of an estuarine isopod were studied. (Bopp-NSIC)
W71-09185 terns across the granite outcrop. (2) Investigations

#### EFFECTS OF LIMNOLOGICAL FACTORS ON UPTAKE OF CESIUM-137 FALLOUT BY FISH. TECHNICAL PROGRESS REPORT, JUNE 1969-FEB. 1970,

Michigan State Univ., East Lansing. Niles R. Kevern, Steven Spigarelli, and James

Available from the National Technical Information Service as COO-1795-2, \$3.00 in paper copy, \$0.95 in microfiche. Report COO-1795-2, 1970. 13 p.

Descriptors: \*Bass, \*Lakes, \*Radioisotopes, Cesium, Potassium, Alkalinity, Conductivity, Absorption, Ion exchange, Radiochemical analysis, Water analysis, Trophic level, Water pollution effects. Identifiers: \*Cesium radioisotopes.

Bass samples were collected from five lakes during 1968 and from all six lakes during 1969. A new technique of wet ashing fish was developed which decreases the analysis time and ensures against the loss of cesium caused by thermal volatilization. A portion of the bass samples was analyzed for cesium-137 and cesium and the results show an inverse relationship with the specific conductance of the water and a direct relationship with the concentration of cesium-137 in the water. A new technique of analyses of lake water involving the use of an ion-exchange resin that is specific for cesium was developed. Objectives of the study were to determine the effect of selected water quality parameters on cesium-137 uptake on fish (alkalinity, conductivity, cesium, potassium). Premises on which the study is based have been supported. (Bopp-NSIC) W71-09186

INTERACTION OF TRACE ELEMENTS WITH THE ORGANIC CONSTITUENTS IN THE MARINE ENVIRONMENT, Bhabha Atomic Research Centre, Bombay (India). M. V. M. Desai, and A. K. Canguly. Available from the National Technical Information Service as BARC-488, \$3.00 in paper copy, \$0.95 in microfiche. Report BARC-488, 1970. 117 p, 15 in 41 tab 47 ref fig, 41 tab, 47 ref.

Descriptors: \*Radioisotopes, \*Organic compounds, \*Marine algae, Phytoplankton, Humic acids, Fulvic acids, Trace elements, Chemical analysis, Ion exchange, Absorption, Strontium radioisotopes, Zinc radioisotopes, Cobalt radioisotopes, Uranium radioisotopes, Radium raiodisotopes, Aluminum, Iron, Copper, Magnesi-um, Managnese, Calcium, Chromium, Potassium, Chelation, Metabolism, Nuclear wastes, Water pollution effects.

Identifiers: Manganese radioisotopes, Cesium radioisotopes, Ruthenium radioisotopes, Cesium radioisotopes, Thorium radioisotopes, Iron radioisotopes, Zirconium radioisotopes, Cesium rad

Low-level nuclear wastes dishcharge into the environment the radioisotopes of zinc, manganese, iron, cobalt, radium, thorium, uranium, etc. In the present work it is shown that the radionuclides are solubilized by growth products of marine organ-isms. Complexation of radionuclides was studied when phytoplankton was grown in a medium spiked with radionuclides in different phases. Humic and fulvic acids were extracted from sea

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water and analyzed for trace elements. The studies show mechanisms by which the availability may be increased through aquatic food chains to man. (Bopp-NSIC) W71-09188

RADIUM-226 CONTENT OF WATER AND PLANKTON FROM THE CHALK RIVER AREA, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

Available from the National Technical Information Service as AECL-3687, \$3.00 in paper copy, \$0.95 in microfiche. Report AECL-3687, Aug. 1970, 29

Descriptors: \*Radium radioisotopes, \*Water pollution sources, \*Plankton, Lakes, Rivers, Wells, Domestic water.

Identifiers: Canada, Chalk River.

From March 1969-Feb. 1970, 12 localities (including four lakes, the Ottawa River, and well water) were sampled monthly. Water was from 0.1 to 6.2 pCi/l; lake plankton, from 0.1 to 11.1 pCi/g dry weight. This corresponds to the natural background level. (Bopp-NSIC)

# PATHWAYS OF TRACE ELEMENTS IN ARC-TIC LAKE ECOSYSTEMS. PROGRESS RE-PORT, APRIL 15, 1970-APRIL 14, 1971, Alaska Univ., College. Inst. of Marine Sciences.

R. J. Barsdate.

Available from the National Technical Information Service as SAN-310-P-4-10, \$3.00 in paper copy, \$0.95 in microfiche. Report SAN-310-P-4-10, Jan. 1971, 151 p. AEC Contract AT (04-3)-310.

Descriptors: \*Ecosystems, \*Alaska, \*Lakes, Arctic, Productivity, Eutrophication, Red Tide, Silica, Algae, Phytoplankton, Freezing, Temperature, Chelation, Hydrogen ion concentration, Dystrophy, Zine radioisotopes, Cobalt radioisotopes, Phosphorus radioisotopes, Sediments, Trace elements, Volcanoes, Benthic flora, Alkalinity, Photosynthesis, Hydrologic aspects, Magmatic water, Water pollution sources, Identifiers, Zine, Manganese radioisotopes Identifiers: Zinc, Manganese radioisotopes.

This report considers five subjects: The Field Program at Point Barrow; Character and Residence Time for Organic Complexes of Trace Metals Associated with a Red Tide; A Study of Zinc Complexation with Organic Material from a Natural Water System; Physical Limnology, Chemistry and Plant Productivity of a Taiga Lake; and Effects of Volcanic Ashfalls on Alaskan Lakes. (Bopp-NSIC) W71-09190

ECOLOGICAL STUDIES OF RADIOACTIVITY IN THE COLUMBIA RIVER ESTUARY AND ADJACENT PACIFIC OCEAN. PROGRESS REPORT, JULY 1, 1968-June 30, 1969. PART B, BIOLOGICAL ASPECTS.

Oregon State Univ., Corvallis. Dept. of Oceanog-

James McCauley, (comp. and ed.). Available from the National Technical Information Service as RLO-1750-54, \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-1750-54, July 1969. p 97-

Descriptors: \*Radioisotopes, \*Absorption, \*Radioecology, \*Aquatic environment, Ecology, Ecosystems, Estuaries, Estuarine environment, Water pollution effects, Marine fish, Marine organisms, Gastropods, Annelids, Shrimp, Benthic fauna, Trace elements, Phosphorus radionuclides, Zinc radionuclides, Crabs.

Identifiers: Chromium radionuclides.

This report includes 36 papers. Among the more general topics are: Introduction to Biological Aspects of Radioecology, Diversity and Similarity

of Benthic Populations off the Coast of Oregon, Sound Scattering by Marine Organisms in the Northeastern Pacific Ocean, Feeding Habits of Benthic Fish, Plankton and Nutrient Ecology of the Benthic Fish, Plankton and Nutrient Ecology of the Columbia River Estuary, Ecology and Radioecology of Benthic Animals, Radioecology of Benthic Fishes, Trace Element Characterization of Phytoplankton, Trace Element Composition of Northeastern Pacific Foraminifers, Transfer of Radionuclides through a Marine Food Web, and Estuary Ocean Power Statistics Location Estuary-Ocean Boundary Studies. In addition there are nine papers on the uptake of radiophosphorus or radiozinc by marine organisms. (Bopp-NSIC) W71-09191

EVALUATION OF INTERNAL IRRADITION DOSES FROM INGESTION BY HUMAN POPULATION OF FOOD CONTAMINATED BY SR-90 AND CS-137 FOR SETTING LEVELS FOR DISPOSAL IN THE ENVIRONMENT, (IN FRENCH),

Commissariat a l'Energie Atomique, Fontenayaux-Roses (France). Arlette Garnier.

Available from the National Technical Information Service as CEA-CONF-1552, \$3.00 in paper copy, \$0.95 in microfiche. CEA-CONF-1552, 1970, 26 p, 14 fig, 5 tab, 8 ref.

Descriptors: \*Strontium radioisotopes, \*Water pol-lution effects, \*Food chains, \*Mathematical lution effects, \*Food chains, \*Mathematical models, Absorption, Path of pollutants, Nuclear wastes, Environmental engineering, Aquatic environment, Water pollution effects.

Identifiers: \*Cerium radioisotopes.

Models to determine radionuclide intake through foods are described. A model is formulated for the case of constant disposal of waste to the environment, which includes the following: concentration in aquatic food chains, uptake in food by man, and removal of radioactivity by radioactive decay and elimination. (Bopp-NSIC) W71-09192

MECHANISMS OF THE ACCUMULATION OF PLUTONIUM-239 AND POLONIUM-210 BY THE BROWN ALGA ASCOPHYLLUM NODOSUM AND MARINE PHYTOPLANKTON, Polyarnyi Nauchno-Issledovatelskii i Proektnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii, Murmansk (USSR).
V. S. Zlobin, and O. V. Mokanu.
Available from the National Technical Information

Available from the National Technical Information Service as AEC-tr-7205, \$3.00 in paper copy, \$0.95 in microfiche. (Radiobiology), Vol. 10, No. 4, p 584-589, July-August 1970, 3 fig, 4 tab, 18 ref) AEC-tr-7205 from Radiobiologiya.

Descriptors: \*Radioisotopes, \*Phytoplankton, \*Metabolism, \*Absorption, Marine plants, Marine algae, Phacphyta, Aquaria, Particle size, Colloids, Water pollution effects. Identifiers: \*Polonium, \*Plutonium.

Radionuclide uptake by a brown alga was studied in laboratory aquaria; by phytoplankton cultured from surface sea water, in shipboard aquaria. The effect of inhibitors of the cytochrome system (cadmium chloride, sodium cyanide, and ammonium nitrate) indicated that uptake was affected by cell respiration. The radionuclides were shown to be in the form of colloids. The particle size of the plutonium salt was 0.1-0.3 microns; of the polonium salt, 0.3-15 microns. (Bopp-NSIC) W71-09193

ECOLOGICAL SCIENCES DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1970. Oak Ridge National Lab., Tenn. Ecological

Sciences Div.

Available from the National Technical Information Service as ORNL-4634, \$3.00 in paper copy, \$0.95 in microfiche. Report ORNL-4634, Feb. 1971. 141

Descriptors: \*Ecosystems, \*Aquatic habitats, \*Animal populations, \*Radioisotopes, Terrestrial habitats, Information retrieval, Documentation, Ecology, Radioactivity effects, Systems analysis, Drainage effects, Water pollution effects, Absorption, Forest management, Research facilities, Plant abscisions. physiology.

The main headings of this report are: (1) Responses of Animal Populations to Ionizing Radiation, (2) Radionuclide Cycling in Terrestrial Ecosystems, (3) Biogeochemical Ecology Information Center, (4) Responses of Plants to Ionizing Radiation, (5) Systems Ecology, (6) Watershed Aquatic Habitat Interactions, (7) Forest Management, (8) Radionuclide Cycling in Aquatic Systems. (Bopp-NSIC) W71-00194 W71-09194

### THE CRITICAL THERMAL MAXIMUM OF JU-VENILE SPOT, LEIOSTOMUS XANTHURUS, LACEPEDE,

North Carolina State Univ., Raleigh. Dept. of

Zoology.
David Wilder Bridges.
Available from UNC-WRRI, North Carolina State
University, Raleigh, North Carolina 27607: Price \$2.50. Available from the National Technical In-52.30. Available from the National Technical Information Service as PB-200 263, \$0.95 in microfiche. Report No 43, UNC-WRRI, N. C. State University at Raleigh, Publication No 17, Pamlico Marine Laboratory, Jan 1971. 39 p, 5 fig. 5 tab, 34 ref, append. OWRR Project B-004-NC (9).

Descriptors: \*Thermal pollution, \*Water pollution effects, \*Water quality, \*Standards, \*Water temperature, \*Fish physiology, Cooling water, Heated water, Fishkill, Electric power plants, Temperature, Juvenile fishes, \*Juvenile growth stage. Identifiers: Critical thermal maximum.

The Critical Thermal Maximum (CTM) of juvenile spot was determined throughout their first growing season from the time they entered the oligohaline environment until they left it. Spot were acclimated in the laboratory to combinations of temperature and salinity levels prior to the CTM tests. When the data were analyzed by multiple regression, acclimated tion temperature, acclimation salinity, weight, weight squared, and length were all found to be significantly important influences on the CTM of juvenile spot. Temperature was the most important influence on CTM with an R2 value of 0.92. Salinity was the least important with an R2 of 0.001, and weight, weight squared and length were all inter-mediate influences with R2 values of about 0.18. Response surfaces were generated from the prediction equation showing the acclimation temperature necessary to produce a fixed CTM for juvenile spot. These reveal that CTM increases with size (either length or weight) and age during the nursery period. The increase in CTM was somewhat greater between summer and fall sized spot than between spring and summer sized spot. The CTM increased as salinity increased. (Howells-North Carolina) W71-09212

MIGRATION AND METABOLISM IN A STREAM ECOSYSTEM,
North Carolina Univ., Chapel Hill. Dept. of Zoology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering. For primary bibliographic entry see Field 05A.
W71-09213

#### ECOLOGY AND POLLUTION OF THE EN-VIRONMENT (in French).

d'Informations Scientifiques Techniques, No 151, p 3-73 (Sept 1970).

Descriptors: \*Strontium radioisotopes, \*Water pollution effects, Nuclear wastes, Rivers, Absorption, Fish, Mollusks, Marine animals, Cobalt radioisotopes, Food chains, Irrigation, Flow profiles, Marine algae, Winds, Sea water, Physicochemical perpetties. Physicochemical properties.

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5C-Effects of Pollution

Identifiers: \*Cesium radioisotopes, \*Ruthenium radioisotopes, Zirconium radioisotopes.

A collection of articles which includes the following topics: Plants and Particulate Atmospheric Pollution (Wind Tunnel Experiments), Uptake of Radionuclides by Marine Biota, In-Situ Contamination of Marine Biota by Ruthenium-106 and Zirconium-95, Physicochemical Behavior of Ruthenium in Sea Water, A Cesium Source for Irradiation Studies of Marine Organisms, Simulation of Natural Flow in River Pollution Studies, Migration of Fission Products through Soil, Uptake of Radionuclides by Vegetables from Irrigation Water. (Bopp-NSIC)

## THE RAIN FOREST PROJECT. ANNUAL RE-

PORT,
Puerto Rico Univ., Rio Piedras.
Carl F. Jordan, and George E. Drewry.
Available from USAEC Depository Libraries.
Atomic Energy Commission Technical Report,
PRNC-129, Dec 31, 1969. 144 p. Contract AT (40-

Descriptors: \*Tritium, \*Radioisotopes, \*Tracking techniques, Fallout, Ecosystems, Rain forests, Strontium radioisotopes, Zinc radioisotopes,

Radioecology.
Identifiers: Cesium radioisotopes, Manganese radioisotopes, Rubidium radioisotopes, Zirconium radioisotopes, Cerium radioisotopes.

The ecology and radionuclide transport were studied for a tropical rain forest with an elevation of 1500 feet in eastern Puerto Rico. Contents of calcium, copper, iron, potassium, magnesium, manganese, sodium, and phosphorus in various compartments of the ecosystem were determined from contents in leaves, bark, roots, litter, organic matter in the forest and biomass of the soil. Rates of movement of each element were related to rainfall and season. Fallout distribution was studied in terms of species, site, canopy, and presence of epiphylls on leaves. Cerium-144, cesium-137, and zirconium-95 were used as tracers. The movements of injected cesium-137, manganese-54, rubidium-86, and strontium-85 through various species of trees was followed. Tritium transport was studied in a plot to which tritiated water was applied by simulated rainfall. Runoff water was collected both beneath the litter and to a depth of five inches in the soil. A pulse of tritium was injected into a tree and the quantities determined: (1) time for tritium to reach the canopy, (2) residence half life of tritium in the free water, and (3) amount of tritium bound in the leaves by photosynthesis. The amount of tritium lost by evaporation from the soil was also determined. Ecological data is presented for plants within an area subjected to gamma irradiation in 1965. (Bopp-NSIC) W71-09226

## RADIONUCLIDE CYCLING IN NATURAL POPULATIONS OF AMPHIBIANS. ANNUAL PROGRESS REPORT, JUNE 16, 1969-JUNE 15, 1970.

Oregon State Univ., Corvallis. David L. Willis.

Atomic Energy Commission Technical Report, RLO-2093-2, 1970. 3 p.

Descriptors: \*Newts, \*Absorption, \*Radioisotopes, Cobalt radioisotopes, Zinc radioisotopes, Iodine radioisotopes, Water pollution effects, Temperature.

Identifiers: Manganese radioisotopes, Sulfur radioisotopes, Rubidium radioisotopes, Cesium radioisotopes.

Uptake and retention of radionuclides by newts was studied (manganese-54, cobalt-60, zinc-65, sulfur-85, rubidium-86, iodine-131, and cesium-134). The equilibrium value for cesium uptake from water was approached after 50 days. Component biological half lives of cesium were 9.6 and 42.8 days at 23 deg C, and 53.8 days (a single component) at 10 deg C. Cesium concentration was highest in the soft tissue. The equilibrium manganese uptake was approached in one month. After 16 days manganese was equally partitioned between skeletal muscle, skin, bone, and liver. Long-term biological half lives after acute administration were: 114 days for cobalt, 1260 days for zinc, 131 days for strontium, and 210 days for iodine. (Bopp-NSIC) W71-09227

# USSR REPORTS ON RADIOACTIVITY IN MAN AND THE ENVIRONMENT. New York Operations Office (AEC), New York.

Available from NTIS. Atomic Energy Commission Technical Report, AEC-tr-7214, 1970. 308 p.

Descriptors: \*Radioisotopes, \*Absorption, \*Food chains, Water pollution effects, Path of pollutants, Fallout, Milk, Ecology, Water pollution control, Control, Radioactivity effects, Surface waters, Soil contamination.

Translations of 39 reports give a substantial coverage of the various aspects of concentration of radioactivity in air, surface water, soils, vegetation, and man; including pathways and distribution in the environment. (Bopp-NSIC) W71-09228

#### **EVALUATION OF RADIOACTIVE POLLUTION** TRANSFER TO OCEAN AND SEA FOOD CHAINS (in French),

Commissariat a l'Energie Atomique, Fontenayaux-Roses (France).

R. Bittel, and G. Lacourly.

Available from NTIS. Comissariat a l'Energie Atomique Conference Report, CEA-CONF-1465,

Descriptors: \*Food chains, \*Radioisotopes, \*Absorption, Water pollution effects, Control, Sea water, Human population, Public health, Water pollution control, Strontium radioisotopes, Foreign research, Nuclear wastes. Identifiers: Cesium radioisotopes.

A research program is outlined to determine parameters needed to estimate the radioactivity ingested from seafood in the diet. (Bopp-NSIC) W71-09229

## LEVEL OF RADIOACTIVE CONTAMINATION IN THE ENVIRONMENT AND IN THE FOOD CHAIN. ANNUAL REPORT, 1968 (in French). Commissariat a l'Energie Atomique, Fontenay-

aux-Roses (France).

Available from NTIS. Euratom Report, EUR-4411 f, Sept 1969. 62 p.

Descriptors: \*Food chains, \*Radioisotopes, \*Absorption, Strontium radioisotopes, Nuclear wastes, Fallout, Water pollution effects, Water pollution control, Control, Iodine radioisotopes, Metabolism, Public health.

Identifiers: Cesium radioisotopes.

Research is reported concerning the radioactive contamination of the environment and of food chains. (Bopp-NSIC) W71-09230

## SELECTED BIBLIOGRAPHY OF TER-RESTRIAL, FRESHWATER AND MARINE RADIATION ECOLOGY,

Washington State Univ., Pullman; and Colorado

Vincent Schultz, and F. Ward Whicker.

Available from NTIS. Atomic Energy Commission Report, TID-25650, 1971, 185 p.

Descriptors: \*Radioecology, \*Terrestrial habitats, \*Sea water, \*Fresh water, Radioactivity effects,

Radioisotopes, Water pollution effects, Wildlife, Documentation, Fallout, Nuclear wastes, Metabolism, Animal metabolism, Nutrient requirements, Tracers, Bibliographies.

Includes radiation effects or metabolic studies involving radionuclides on wild species of plants and animals. Studies of laboratory or domestic organisms are included when the studies are of an ecological nature, e.g., on population growth or-synergistic. Studies of soils or of the atmosphere are not included. The references are arranged alphabetically by author under 18 headings (Introduction, Status and Needs of Radiation Ecology, etc. There is no subject index. In 1969 and particularly 1970, the coverage has not been completed. (Bopp-NSIC) W71-09232

#### NATURAL ENVIRONMENTAL RADIOACTIVI-TY. AN ANNOTATED BIBLIOGRAPHY, Nevada Operations Office (AEC), Las Vegas Alfred W. Klement, Jr.

Available from NTIS. Atomic Energy Commission Technical Report, WASH-1061 (Suppl), Apr

Descriptors: \*Radioisotopes, \*Radioactivity, \*Soil contamination, \*Water pollution, Air pollution, Radioactivity effects, Water pollution effects, Air pollution effects, Soil contamination effects, Ab-

This supplement to WASH-1061 includes references obtained since July 1965 on the topics: general, atmosphere, biological materials, soils, waters, and groundwater. Nuclear Science Abstracts and Chemical Abstracts were the major sources of reference. (Bopp-NSIC) W71-09234

## EFFECT OF COBALT ON SEA URCHIN MORPHOGENESIS, California Univ., Livermore. Lawrence Radiation

Mary M. Barrett, and Hector Timourian. Available from NTIS. UCRL-50717, July 16, 1969.

Descriptors: \*Invertebrates, \*Cobalt, \*Pathology, Sea water, Embryonic growth stage, Toxicity, Water pollution effects, Resistance, Radioactivity techniques, Cobalt radioisotopes.

Cobalt uptake contrasted with that of zinc since cobalt appeared to remain in equilibrium with the exterior source, and could be washed out. Sea urchin embryos removed from cobalt solutions after 24 hour exposure were capable of normal development. At low concentrations of cobalt in artificial sea water, 10 to the minus 4th power to 10 to the minus 5th power molar, the effects of cobalt were mainly on the skeletal structures. Uptake of cobalt-60 did not take place during the early cleavage stages and reached an equilibrium at 35 hours. (Bopp-NSIC) W71-09239

#### INSTRUMENTATION RESEARCH FOR RADIA-TION MEASUREMENTS IN THE MARINE EN-VIRONMENT.

Scripps Institution of Oceanography, La Jolla, Calif

T. R. Folsom.

Available from NTIS as AD-704 877. SIO REF 70-15, Apr 1970. 22 p, 45 ref.

Descriptors: \*Radioisotopes, \*Oceanography, \*Sea water, Fallout, Programs, Bibliographies, Instrumentation, Ocean circulation, Water pollution effects, Radioactivity techniques. Identifiers: \*Cesium radioisotopes.

New methods for surveying fallout constituents, particularly cesium-137, have led to information about the Pacific Ocean, especially its shallower

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layers. Further study of the long persistence of water properties near 100 meters seems desirable. Abstracts of reports and journal articles from the Institute of Marine Resources during the past 6 years are appended. (Bopp-NSIC) W71-09242

**UPTAKE OF NITROSYL RUTHENIUM-106 ON** CHITIN AND CHITOSAN FROM WASTE SOLUTIONS AND POLLUTED SEA WATER, Bologna Univ. (Italy).

R. A. A. Muzzarelli.

Water Research, Vol 4, no 6, p 451-455, June

Descriptors: \*Nuclear wastes, \*Waste water treatment, \*Water pollution control, Absorption, Radioecology, Radioactivity techniques, Chelation, Crabs, Chromatography. Identifiers: \*Ruthenium radioisotopes.

Chitin and chitosan, two polymers obtained from crab shells, are proposed as chromatographic supports for collection of nitrosyl ruthenium-106 from waters contaminated by nuclear wastes. The polymers can also find application for the pollution survey of sea water. (Bopp-NSIC) W71-09246

#### THE OCEANS - WORLD SUMP,

Oregon State Univ., Corvallis.

J. W. Hedgpeth.

Environment, Vol 12, No 3, p 40-47 (Apr 1970). 3 fig, 17 ref.

Descriptors: \*Water pollution sources, \*Radioisotopes, \*Thermal pollution, Nuclear wastes, Ecology, Oceans.

The capacity of the oceans for absorbing wastes is limited. Continuing to seek solutions to waste disposal problems which involve merelymanipulation of the environment is borrowing time that does not exist. The only ultimate solution is to reduce the impact of people on the environment. W71-09247

## TEMPERATURE EFFECTS ON THE SORPTION OF RADIONUCLIDES BY FRESHWATER AL-GAE,

Savannah River Lab., Aikan, S.C.

R. S. Harvey. Health Physics, Vol 19, No 2, p 293-297 (Aug 1970). 4 fig, 3 tab, 7 ref.

Descriptors: \*Aquatic algae, \*Radioisotopes, Absorption, Temperature, Strontium radioisotopes, Zinc radioisotopes, Cobalt radioisotopes, Water pollution effects, Fresh water.

Identifiers: \*Cesium radioisotopes, Iron

radioisotopes, Manganese radioisotopes.

Water temperatures of 23-32 deg C did not affect the sorption of cesium-137, strontium-85, zinc-65, iron-59, cobalt-57, and manganese-54 by the filamentous green alga, stigeoclonium lubricum. Radionuclide concentrations in the unicellular diatom, navucila seminulum, were 2-5 times higher at 32 deg C than at 23 deg C. Water temperatures of 25-40 deg C had no significant effect on the sorption of cesium-137, strontium-85, zinc-65, and iron-59 by the filmentous blue-green alga, plectonema boryanum. However, cobalt-57 concentrations in P. boryanum decreased with temperature, and manganese-54 concentrations increased from 25-35 deg C. Growth of S. lubricum was not affected by the temperature. (Bopp-NSIC) W71-09250

## DARIEN GASTROPOD POLYCLAVE (BIOEN-VIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES. ATLANTIC-PACIFIC CANAL),

Battelle Memorial Inst., Columbus, Ohio. James A. Duke.

Available from NTIS. Betelle Technical report. BMI-171-35, Mar 1970. 75 p.

Descriptors: \*Gastropods, \*Canals, Pacific Ocean, Atlantic Ocean, Tropical regions, Feasibility stu-dies, Ecology, Competition, Documentation, dies, Ecology, Cor Estuaries, Fresh water.

An ecological study of gastropods (snails) was conducted in connection with feasibility studies for the proposed sea-level canal. An inverted index is presented to the occurrence of various taxonomic and ecologic attributes of the genera of gastropods found or expected in the littoral, estuarine, freshwater, and terrestrial ecosystems of Panama. Feeding habits and transport of gastropods through the proposed canal are discussed with relation to their ecological significance. (Bopp-NSIC)

## DARIEN PELECYPOD POLYCLAVE (BIOEN-VIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES. ATLANTIC-PACIFIC CANAL),

Battelle Memorial Inst., Columbus, Ohio. James A. Duke.

Available from NTIS. Batelle technical report BMI-171-36, Apr 1970. 43 p.

Descriptors: \*Mollusks, \*Canals, Pacific Ocean, Atlantic Ocean, Tropical regions, Feasibility studies, Ecology, Competition, Documentation, Information retrieval.

An ecological study of pelecypods (mollusks) was conducted in connection with feasibility studies for the proposed sea-level canal. An overlay information-retrieval system for taxonomic identification of 300 genera of pelecypods is presented. The data indicate that pelecypods are insignificant as potential hazards if introduced into the opposite side of the isthmus and that important food species in the isthmian region would not be endangered by transit of pelecypods. (Bopp-NSIC) W71-09252

## RADIOECOLOGICAL STUDIES OF TRITIUM MOVEMENT IN A TROPICAL RAIN FOREST. THE PROCEEDINGS OF THE SYMPOSIUM ON ENGINEERING WITH NUCLEAR EXPLO-SIVES, LAS VEGAS, NEVADA, JAN. 14-16,

California Univ., Levermore. Lawrence Radiation

J. R. Martin, C. F. Jordan, J. J. Koranda, and J. R. Kline

Available from NTIS. Atomic Energy Commission Conference Proceedings CONF-700101- (Vol 1).

Descriptors: \*Tritium, \*Absorption, \*Rain forest, Puerto Rico, Tracers, Ecosystems, Plant growth, Runoff, Soil contamination, Nuclear explosions, Water pollution effects, Soil contamination effects.

Several experiments on the movement of tritium were conducted in a montane rain forest of eastern Puerto Rico. Tritiated water was used as a tracer for water movement in mature evergreen trees of the rain forest, soil and substory vegetation, and rapidly growing species. Based on all experimental data, the distribution of tritium from a simulated rainout following a one megaton thermonuclear detonation is presented. (Bopp-NSIC)

## THE EFFECTS OF ENVIRONMENTAL STRESS ON THE COMMUNITY STRUCTURE AND PRODUCTIVITY OF SALT MARSH EPIPHTIC

COMMUNITIES, City College, New York.

Available from NTIS. Atomic Energy Commission Technical Report NYO-3995-14, Jan 1970. 46 p.

Descriptors: \*Ecosystems, \*Salt marshes, \*Productivity, Radioisotopes, Strontium radioisotopes, Algae, Plant growth, Temperature, Protozoa, Chlorophyta, Absorption.

The following topics are considered: Removal of calcium-45 and strontium-89, -90 from coastal environments by calcareous foraminifers (protozoa); Growth and reproduction of foramifers and epiphytic algae; Effect of temperature and light on enteromorpha (algae) and its epiphytes; Stimula-tion of growth of 9 out of 11 representative eipihytic algae by either arginine or alanine; and Progress in other subprojects. (Bopp-NSIC) W71-09254

## MECHANISMS OF RADIOECOLOGICAL CON-CENTRATION PROCESSES IN SEAS AND OCEANS,

Institute of Biology of the Southern Seas,

Sevastopol (USSR).
G. G. Polikarpov.
Available from NTIS. Atomic Energy Commission translation AEC-tr-7030, (1969), p 49-64.

Descriptors: \*Marine animals, \*Marine plants, \*Radioisotopes, Water pollution effects, Absorption, Food webs, Sea water, Oceans, Plankton, Phaeophyta, Programs, Radioecology.

Concentration of radionuclides in food webs is discussed. Similarities in uptake between related species are significant for extrapolation of data, and effects of parameters (salinity, concentration in sea water) are considered. Radioecology programs at the author's research institute are discussed. (Bopp-NSIC) W71-09255

# SOME OBSERVATIONS ON ALGAE INVADING A CESIUM-137 CONTAMINATED POND, Atomic Energy of Canada Ltd., Pinawa

(Manitoba).

Janet R. Dugle, and J. E. Guthrie. Available from NTIS. Atomic Energy of Canada technical report AECL-3463, (1970). 12 p.

Descriptors: \*Aquatic algae, \*Radioactivity effects, \*Ponds, Water pollution Radioisotopes, Competition, Speciation. Identifiers: \*Cesium radioisotopes.

A comparison of the species of algae found at various collection sites within two ponds, one contaminated with cesium-137, was made in October 1968. These observations will form the basis of a study of the succession of algal species in pond communities. (Bopp-NSIC) W71-09256

### UTILITY OF RADIOISOTOPE METHODOLOGY IN ESTUARY POLLUTION CONTROL STU-DIES,

Quirk, Lawler, and Matlsky Engineers, New York. Karin A. Abood, John P. Lawler, and M. D. Disco. Available from NTIS. Atomic Energy Commission technical report NYO-3961-1, Aug 1969. 197 p.

Descriptors: \*Tracers, \*Flow characteristics, \*Radioisotopes, River flow, Estuaries, Dispersion, Radioactivity techniques.

A general procedure for a tracer field survey has been developed which is suitable for measurement of dispersion and flow characteristics in freshwater rivers and estuaries. Radiotracers appear to meet the technical requirements of an ideal tracer better than other materials: however nontechnical aspects have hindered adoption of radioisotope techniques. (Bopp-NSIC) W71-09257

#### THE ADHESIVE PROPERTIES OF 'CHLOREL-LA VULGARIS',

Puerto Rico Univ., Mayaguez. Dept. of Marine

Thomas R. Tosteson, and Luis R. Almodovar.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5C—Effects of Pollution**

Available from the National Technical Information Service as AD-721 114, \$3.00 in paper copy, \$0.95 in microfiche. ONR technical report, no. TR-1, Apr. 1971, 35 p.

\*Chorella, \*Algae, \*Fouling, Descriptors: Nuisance algae, Floating plants, Scawater, Plankton, Biodegradation, Light, Temperature.
Identifiers: Acrylic resins, Glass, Thymidines, Cells (Biology), \*Biodeterioration, Democolcine.

Ambient sea water contains material that promotes the adhesion of the planktonic algae Chlorella vulgaris to plastic surfaces. This adhesion takes place within 3 tp 6 hours, and is inhibited by the absence of light. The effect of light on the response of Chlorella to the ocean treated surface is due to the effect of light on the rate of growth of the algae population. The adhesion of Chlorella to glass surfaces is significantly increased in the presence of thymidine and colcemide. Thymidine accelerates the rate of growth of the algal cells and colcemide blocks this growth during mitosis. The effect of ocean deposited materials on the adhesion of Chlorella to plastic appears similar to the effect of agents that increase the relative number of cells to the G2 phase of the cell cycle on the adhesion of this cell to glass. W71-09261

#### SYMPOSIUM ON ENVIRONMENTAL LEAD CONTAMINATION, HELD ON DECEMBER 13-

Public Health Service, Washington, D.C.

Available from the National Technical Information Service as PB-198 104, \$3.00 in paper copy, \$0.95 in microfiche. Public Health Service Publication no 1440, Mar 1966.

Descriptors: \*Water pollution, \*Water pollution effects, \*Air pollution, \*Public health, Toxicity, Water quality control, Industrial wastes, Diets. Identifiers: \*Lead, Toxicology, Tetraethyl lead, Antiknock additives, Food contamination, Exhaust gases, Combustion products, Air pollution effects.

The ways by which lead enters the environment are examined. The effects of lead on human health are discussed. Measures which may be needed to minimize the effects are explored. Included are reports on: Estimation of Sources of Atmospheric Lead and Measured Atmospheric Lead Levels; The Diet as a Source of Lead in Drinking water; Recent History of Lead Exposure in U.S. Industry, 1935-1965; Under What Circumstances is Inhalation of Lead Dangerous; Under What Circumstances is Ingestion of Lead Dangerous; Under What Circumstances is Direct Contact With Lead Dangerous; How Sensitive and How Appropriate are our Current Standards of 'Normal and Safe' Body Content of Lead; Possibilities of Removal of Sources of Lead Contamination in the Environment; Evaluation of Use vs. Non-use of Tetra-cthyl Lead in Gasoline; Refining to Produce Gasolines of Reduced Lead Content. W71-09264

## CHANGES IN THE CHEMICAL COMPOSITION OF SEDIMENTS OF LAKE WASHINGTON, 1958-1970,

Minnesota Univ., Minneapolis. Limnological Research Center; and Washington Univ., Seattle.

Dept. of Zoology.
For primary bibliographic entry see Field 05B. W71-09281

## FORMATION OF METHYL MERCURY FROM PURE MERCURIC SULPHIDE IN AEROBIC ORGANIC SEDIMENT, Swedish Water and Air Pollution Research Lab.,

For primary bibliographic entry see Field 05B. W71-09296

## POLLUTION PROBLEMS IN THE 'OIL

PATCH',
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05B.

## STUDIES ON THE RADIOACTIVE CON-

TAMINATION OF THE SEA,
European Atomic Energy Community, Brussels
(Belgium); and Comitato Nazionale per l'Energia
Nucleare, Bologna (Italy). M. Bernhard.

Available from Office for Official Publications of the European Communities, PO Box 1003, Luxembourg/gare 37, rue Glesener, Luxembourg. Studies on the Radioactive Contamination of the Sea, European Atomic Energy Community and Comitato Nazionale Per L'Energia Nucleare, Annual Report 1968-69, 1971. 109 p, 4 fig, 3 tab, 25 ref. EUR 4508e, CNEN Report No RT/BIO (70)-11, Association No 074-69-1 BIAI.

Descriptors: \*Oceans, \*Radioactivity, \*Water pollution, \*Environment, \*Chemistry, \*Food chains, lution, \*Environment, \*Chemistry, Fisheries, \*Biology, Microorganisms, Fisheries Radioisotopes, Absorption. Identifiers: \*Trophic levels, \*Heterotrophic levels. Microorganisms,

The factors which influence the uptake, accumulation and loss of radioisotopes by different inorganic and organic constituents of the marine environment are studied. A survey of environmental elements and factors in a sampling area was made and experiments on the influence of environmental factors on the uptake, accumulation and loss of radioisotopes by different inorganic and organic constituents of the marine environment in relation to the data obtained in the survey were conducted.

(Ensign-PAI) W71-09366

## A MODULAR CONTROLLED-TEMPERATURE APPARATUS FOR FISH EGG INCUBATION AND FRY REARING,

Federal Water Quality Administration, Duluth, Minn. National Water Quality Lab. For primary bibliographic entry see Field 05A. W71-09368

#### EFFECT OF TEMPERATURE AT DIFFERENT ALTITUDES ON THE EMERGENCE OF INSECTS FROM A SINGLE AQUATIC

STREAM, Federal Water Quality Administration, Duluth, Minn. National Water Quality Lab. Alan V. Nebeker.

Journal of the Kansas Entomological Society, Vol 44, No 1, p 26-35, Jan 1971. 1 fig, 12 tab, 4 ref.

Descriptors: \*Aquatic insects, \*Stoneflies, \*Water temperature, \*Photoperiodism, Larvac, Growth stages, Inhibition, Utah, Light duration.

Identifiers: \*Insect emergence, Plecoptera, Brachyptera sp., Capnia sp., Leuctra sp., Eucapnopsis sp., Nemoura sp., Perlomyia sp., Development.

The effects were analyzed of temperature as influenced by altitude on the seasonal distribution and adult emergence of 13 winter stoneflies (Plecoptera) in a single stream. Water temperature of the stream, when modified by the air temperature, solar insolation, snow cover and springs, produced significant changes in insect emergence patterns. Three main types of emergence patterns are apparent: (1) where the temperature is the main influence on the time emergence occurs, even though photoperiod may be the initial stimulus; (2) where photoperiod is the main regulation; and (3) where the photoperiodic stimulus is modified-emergence occurs at about the same time in most of the canyon but is delayed by colder tempera-tures at the high elevations. (LeGore-Washington) W71-09370

## AN ELECTRODE CHAMBER FOR RECORD-ING RESPIRATORY AND OTHER M MENTS OF FREE-SWIMMING ANIMALS,

Federal Water Quality Administration, Duluth, Minn; and Cincinnati Univ, Ohio, Dept. of Biologi-

W. A. Spoor, T. W. Neiheisel, and R. A.

Transactions of the American Fisheries Society, Vol 100, No 1, p 22-28, Jan 1971. 5 fig, 19 ref. FWPCA Grant No WP-01317-01.

Descriptors: \*Bioassay, \*Analytical techniques, \*Fish physiology, \*Water pollution effects, \*Methodology, Laboratory animals, Fish behavior, Fish diseases, Environmental effects, Laboratory equipment, Laboratory tests, Monitoring. Identifiers: \*Physiological monitoring, \*Experimental physiology, Laboratory recording equipment, Experimental designs.

By their effects on equilibrium potentials, water currents produced by respiratory and other move-ments of freely-moving animals cause changes in the potential difference between stainless steel electrodes set at opposite ends of an open system continuous-flow animal chamber. The changes are in the microvolt range, but they can be used for continuous or intermittent recording of the animal's responses in short-term or long-term stu-dies inder widely varied environmental conditions, and the method seems suitable for monitoring. Sensitivity of the apparatus was tested. Variations in dissolved oxygen from less than 0.2 ppm to satura-tion, in free CO2 concentration from 0.0 to 30.. ppm, in temperature from 0 to 30C, and in pH from 3 to 11 are not limiting. (LeGore-Washington) W71-09372

## CARBAMATE BIOASSAY USING DAPHNIA

Cornell Univ., Ithaca, N.Y. Dept. of Entomology. For primary bibliographic entry see Field 05A. W71-09373

ABOUT THE MAXIMUM PERMISSIBLE POL-LUTION OF SURFACE WATERS BY OIL AND OIL PRODUCTS OWING TO THEIR EFFECT ON THE WATER FAUNA AND ON THE OR-GANOLEPTIC PROPERTIES OF WATER (IN CZECH).

Vyskumny Ustav Vodohospodarsky, Bratislava (Czechoslovakia).

Josef Rothschein.

German and English summaries. Vyskumny Ustav Vodneho Hospodarstva Bratislava, Informacie 26, 1970. 59 p, 12 fig, 15 tab, 35 ref.

Descriptors: \*Oily water, \*Gasoline, \*Bioassay, \*Water pollution effects, \*Organoleptic properties, \*Impaired water quality, Oil, Oil wastes, Water pollution sources, Lethal limit, Fish, Daphnia, Oligochaetes, Aquatic environment, Fish, Odor, Potable water, Water quality.

Identifiers: \*Oil pollution, \*Refinery wastes, Oil spills, Oil products.

Fish, oligochaetes (Tubifex), and Daphnia were used to determine the toxicity of desalted crude oil. gas oil,' petroleum, gasoline, and waste water from fuel processing. Daphnia were the most sensitive to the above products, fish next, and oligochaetes were most tolerant. Toxicity depended to a large degree on the ability of the product to emulsify in water. The odor threshold of the substances in water ranged from 1/2 to 1/10 of their lethal values, and it is very difficult to produce potable water from a stream receiving refinery wastes. (Katz and LeGore-Washington) W71-09374

# EFFECTS OF HYPOXIA UPON RESPIRATION AND CIRCULATION IN THE DOGFISH SCYLIORHINUS STELLARIS,

Max-Planck-Institut fuer Experimentelle Medizin, Goettingen (Germany). Dept. of Physiology. J. Piiper, Doris Baumgarten, and M. Meyer

Comparative Biochemistry and Physiology, Vol 36, p 513-520, 1970. 2 tab, 19 ref.

Descriptors: \*Fish physiology, \*Dissolved oxygen, \*Elasmobranches, \*Sharks, \*Respiration, \*Circulation (Animals), Environmental effects, Oxygen sag, Fish behavior, Oxygen demand, Oxygen requirements.

Identifiers: \*Hypoxia, Dogfish, Heart rate, Cardiac output, Blood pressure, Oxygen consumption.

Changes in respiration and circulation induced by hypoxia were studied in the dogfish, Scyliorhinus stellaris, by reducing the oxygen pressure in ambient water from 142 mm Hg to 54 mm Hg. The following changes were observed: (a) O2 uptake decreases markedly, (b) respiratory rate did not change significantly, but the ventilation rate increased showing a province of the contract of the creased, showing a maximum at moderate hypoxia, (c) heart rate decreased, and cardiac output measured according to the Fick principle also showed a slight tendency to decrease, and (d) mean blood pressure in the ventral aorta and in peripheral arteries decreased. The effects of hypoxia are mostly in agreement with those found in other elasmobranchs, but differ in many respects from changes observed in teleosts. (LeGore-Washington) W71-09375

REPORT ON A FISH KILL AT LAGUNA JOYU-DA, WESTERN PUERTO RICO, IN THE **SUMMER, 1967,** 

Auburn Univ., Auburn, Alabama, and Florida State Univ., Tallahassee, Dept. of Oceanography. Francisco A. Pagan, and Herbert M. Austin. Caribbean Journal of Science, Vol 10, Nos 3-4, p 203-208, Sept-Dec 1970. 2 fig, 1 tab, 1 ref.

Descriptors: \*Fishkill, \*Mortality, \*Dissolved oxygen, \*Oxygen sag, \*Salinity, \*Environmental effects, \*Water temperature, Crabs, Shrimp, Doughts, Water quality, Physiological ecology, Climatology, Puerto Rico.
Identifiers: \*Natural mortality, Laguna Joyunda

(Puerto Rico).

A mass mortality which occurred in Laguna Joyunda, Puerto Rico, on June 7, 1967, was investigated. Several species of fish, the blue crab (Callinectes sp.) and one species of peneid shrimp were killed. High air temperatures and severe drought were concluded to have interacted with high levels of night plant respiration, resulting in rapid water evaporation, high salinity (to 43-44 ppt), low dis-solved oxygen values (less than 0.5 ppm) and high water temperature (35 C). The mortality was deemed to have been caused by natural phenomena. The situation is compared with a similar mortality that occurred in Laguna Joyuda in 1963. (LeGore-Washington) W71-09376

FISH-TOXICITY PROBLEMS OF PESTICIDES IN JAPAN - THE PRESENT SITUATION AND THE POLICIES OF THE MINISTRY OF AGRICULTURE AND FORESTRY,

Agricultural Chemical Inspection Station, Tokyo (Japan).

For primary bibliographic entry see Field 05A. W71-09377

EFFECT OF SESAMEX ON BRAIN ACETYLCHOLINESTERASE INHIBITION BY PARATHION IN FISHES, Mississippi State Univ, State College, Dept. of

Zoology.

James R. Gibson, and J. Larry Ludke. Bulletin of Environmental Contamination and Toxicology, Vol 6, No 2, p 97-99, 1971. 1 tab, 8 ref.

Descriptors: \*Organophosphorous pesticides, \*Toxicity, \*Biochemistry, \*Pesticide toxicity, \*Fish physiology, Inhibition, Bioassay, Inhibitors, Enzymes, Sunfishes, Lepomis species, Shiners, Bluegills, Pathology, Water pollution effects, Water pollution treatment, Pesticides.

Identifiers: \*Sesamex, \*Parathion, Toxic mechanisms, Mechanisms of toxicity, Brain, Acetylcholinesterase, Golden shiner, Notemigonus sp., Nervous tissue.

The toxic action of parathion is generally considered to result from inhibition of acetylcholinesterase (AChE). Sesamex is a suspected antagonist to this toxic mechanism. This was tested using brain AChE from golden shiners (Notemigonus chrysoleucas), green sunfish (Lepomis cyanellus) and bluegill sunfish (Lepomis macrochirus). Experiments indicated that the degree of brain AChE inhibition resulting from exposure to parathion is decreased by pretreatment of fish with sesamex. The decrease is presumably mediated through inhibition of the enzyme that converts parathion to the potent anticholinesterase, paraoxon. (LeGore-Washington) W71-09378

SENSITIVITY TO PESTICIDES IN THREE GENERATIONS OF SHEEPSHEAD MINNOWS, Bureau of Commercial Fisheries Center for Estuarine and Menhaden Research, Gulf Breeze, Florida, Pesticide Field Station.
Hugh T. Holland, and David L. Coppage.

Bulletin of Environmental Contamination and Toxicology, Vol 5, No 4, p 362-367, 1970. 1 fig, 1 tab, 3 ref. Gulf Breeze Contribution No. 76.

Descriptors: \*DDT, \*Endrin, \*Chlorinated hydrocarbon pesticides, \*Toxicity, \*Fish genetics, \*Water pollution effects, Bioassay, Lethal limit, Minnows, Fish physiology, Fish reproduction, Pesticide toxicity, Fish management, Resistance, Fish populations, Balance of nature, Environmental effects, Fecundity, Persistence.

Identifiers: \*Natural selection, Fish breeding, Sheepshead minnows, Cyprinodon sp.

An attempt was made to determine whether succceding generations of sheepshead minnows (Cyprinodon variegatus) exposed to DDT can develop resistance to DDT, and whether 'cross-resistance' to endrin, a related insecticide, can develop. Static bioassays were utilized. Sensitivity to DDT varied with time of year in both control and experimental generations. Sensitivity did not decrease consistently in any experimental generation, but all decreases observed occurred during the interval March-June. (LeGore-Washington)

### INTERACTION OF PESTICIDES WITH AQUATIC MICROORGANISMS AND PLANK-

Arizona Univ, Tucson, Dept. of Entolmology. George W. Ware, and Clifford C. Roan. Summaries in English, French and German. Residuc Reviews, Vol 33, p 15-45, 1971. 16 tab, 84

Descriptors: \*Reviews, \*Bibliographies, \*Data collections, \*Pesticides, \*Organo-phosphorous pesticides, \*Chlorinated hydrocarbon pesticides, \*Herbicides, \*Pesticide toxicity, \*Water pollution effects, \*Plankton, \*Aquatic microorganisms, Organic pesticides, Insecticides, Toxicity, Lethal limit, Pesticide kinetics, Pesticide residues, Zooplankton, Phytoplankton.

A review is presented of the literature relative to the effects of several pesticides on both zoo- and phytoplankton. Considered are: the introduction of pesticides into the aquatic environment, pesticide toxicity, freshwater and marine microorganisms, organochlorine and organophosphate insecticides, and herbicides. The contrasts in interpretation of toxicity data are discussed and a few possible explanations for this variation are suggested. A table indicating the chemical designations of 81 pesticides is provided. (LeGore-Washington) W71-09381

THE EFFECTS OF WATER HARDNESS ON THE UPPER LETHAL TEMPERATURE OF THE GREEN SUNFISH (LEPOMIS CYANELLUS), New Mexico State Univ., University Park. Thomas Oliver Boswell.

MS Thesis, July, 1967. 31 p, 4 fig, 4 tab, 28 ref. OWRR Project A-003-N MEX (2).

Descriptors: \*Hardness (Water), \*Lethal limit, \*Water temperature, \*Sunfishes, \*Lepomis species, Water properties, Water quality, Temperature, Heated water, Thermal pollution, Heat resistance, Bioassay, Acclimatization, Environment, Physiological ecology. Identifiers: Green sunfish, LD-50, Nerve function.

The effects of water hardness on the upper lethal temperature of the green sunfish were examined. Fish were acclimated and tested at hardness levels of 30, 180 and 400 ppm, and the 48 hr median upper lethal temperatures and critical thermal maxima were determined for acclimation temperatures of 20C and 30C. The significant effects of water hardness on lethal temperatures were observed. Winter-collected fish exhibited lower levels of thermal resistance than did summer-collected fish. Behavioral evidence supports the hypothesis that heat death in green sunfish results from failure of the nervous system. (Katz and LeGore-Washington) W71-09382

AN ASSESSMENT OF THE ASSIMILATION OF ELEMENTAL PHOSPHOROUS BY NEWFOUN-DLAND MARINE ORGANISMS IN THE 1969 POLLUTION PROBLEM AND IN 1970 MONI-TORING OPERATIONS,

Fisheries Research Board of Canada, Halifax, (Nova Scotia). Halifax Lab. For primary bibliographic entry see Field 05A.

THE EFFECT OF PP'-DDT ON TADPOLES OF THE COMMON FROG (RANA TEMPORARIA), Nature Conservancy, Abbots Ripton (England). Monks Wood Experiment Station. A. S. Cooke.

Environmental Pollution, Vol 1, p 57-71, 1970. 7 fig, 3 tab, 25 ref.

Descriptors: \*DDT, \*Water pollution effects, \*Frogs, \*Resistance, Chlorinated hydrocarbon Posticides, Bioassay, Morbidity, Mortality, Growth, Pathology, Self-purification. Identifiers: \*Rana temporaria, \*Tadpoles, DDE.

Tadpoles of the common frog (Rana temporaria L.) were kept for 1 hr in amphibian saline containing 0.01, 0.1, 1.0 or 10.0 ppm pp'-DDT. After treatment in the 0.1, 1.0 or 10.0 ppm DDT media, all tadpoles enter an uncoordinated, hyperactive phase, which can begin after less than 1 hr. This is followed by either a moribund phase and death or by a return to normal activity. Body weight decreases during the hyperactive period, and the development of certain tadpoles is suppressed. Larger tadpoles also become hyperactive during treatment. After treatment, many of these larger tadpoles develop a hole in the snout between the upper mandible and the nostrils, a condition that also retards feeding and development. This abnormal snout reverts to normal after metamorphosis. Smaller tadpoles are more vulnerable to DDT poisoning of the environment. The absolute amount of DDT taken in seems independent of size, so that tissue content is greater for small tadpoles. Rate of loss of pesticide is higher for large tadpoles. In the field, DDT may reduce a frog population by increasing mortality during the larval stage or, more probably, immediately after metamorphosis, or by modifying behavior. Precise evaluation is difficult because of high natural mortality among wild populations. (Katz-Washington) W71-09385

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5C—Effects of Pollution**

## LAKE ERIE: COMMON EFFORT CAN SAVE

Bureau of Commercial Fisheries, Washington, D.C.

Commercial Fisheries Review, Vol 32, No 8-9, p 19-20, Aug-Sept, 1970. 4 fig.

Descriptors: \*Lake Erie, \*Lake fisheries, \*Fisheries, \*Fish management, \*Fish populations, \*Aquatic environment, \*Fish harvest, \*Dissolved Solids, \*Water temperature, \*DDT, \*Heavy metals, Great Lakes, Market value, White bass, Yellow perch, Lake trout, Fish conservation, Fish food organisms, Fishkill, Pounds fish per acre, Fish rood organisms, Fishkill, Pounds fish per acre, Fish populations, Benthic fauna, Dissolved oxygen, Water pollution effects, Rehabilitation, Perches. Identifiers: \*Mercury, Catch statistics, Solids, Climatic changes, Lake rehabilitation.

A general review is given of the fisheries status of the Great Lakes in regard to the effect of environmental changes. There has been a shift in the catch from high value fish to low value fish, such as yellow perch and white bass. Total dissolved solids have increased 50 ppm during the past 50 years. Water temperatures have increased 20F since 1920 due to climate changes. Degradation of the oxygen regime has altered the populations of bottom or-ganisms, which were valuable as fish food. The poundage of fish taken has maintained itself, but the species shift has reduced the value of the catch. DDT values are below 5 ppm, but mercury contamination is serious. The environmental problems of Lake Erie are regarded as complex and discouraging. (Katz-Washington)
W71-09387

#### CHRONIC ENDRIN POISONING IN GOLDFISH, CARASSIUS AURATUS,

Bureau of Sport Fisheries and Wildlife, Columbia, Mo. Fish-Pesticide Research Lab. Blake F. Grant, and Paul M. Mchrle

Journal of the Fisheries Research Board of Canada, Vol 27, No 12, p 2225-2232, 1970. 3 tab, 18 ref.

Descriptors: \*Endrin, \*Lethal limit, \*Pesticide toxicity, \*Water pollution effects, \*Fish physiology, \*Growth rates, \*Inhibitors, Food chains, Pesticide residues, Toxicity, Growth, Gonads, Lipids, Mortality, Inhibition, Pesticides, Pathology, Sodium, Osmosis, Fishkill, Public health.

Osmosis, Fishkin, Tuble health.
Identifiers: \*Goldfish, \*Carassius sp., \*Chronic
pollution, Gonadal development, Thyroid activity,
Blood serum, Histopathology, Osmoregulation.

Endrin incorporated into the diet of mature male goldfish for 3-4 months affected growth, gonad development, thyroid activity, serum characteristics, total and differential body fat, behavior and survival. A biphasic response to endrin dosage was characteristic. Low doses (4.3-43.0 ug/kg body weight/day) either caused no detectable effect or were stimulatory, as indicated by increased growth rates and higher total body fat contents. The two highest doses (143 and 430 ug) caused mortality, lowered growth rates, and caused other chronic symptoms. They also caused decreased thyroid cell heights, inhibited game to-genesis, lowered total body fat, and resulted in less vacuolization in liver cells. All doses except the highest caused elevated serum Na concentrations. The fish receiving the highest dose suffered osmoregulatory failure. Induced spermiation was not affected; fish receiving 143 or 430 ug/kg had greatly reduced, but functional testes. (LeGore-Washington) W71-09388

#### THE EFFECT OF SIZE ON THE UPTAKE OF DDT FROM WATER BY FISH,

Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.

Philip G. Murphy.

Bulletin of Environmental Contamination and Toxicology, Vol 6, No 1, p 20-23, 1971. 2 fig, 6 ref.

Descriptors: \*DDT, \*Pesticide residues, \*Absorption, \*Water pollution effects, \*Path of pollutants,

\*Chlorinated hydrocarbon pesticides, Dieldrin, Chromatography, Food chains, Analytical techniques, Bioassay, Fish food organisms, Pesticide kinetics, Pesticide toxicity, Fish physiology. Identifiers: \*Gas-liquid chromatography, \*Gambusia affinis, Mosquito fish, DDT-Carbon-14.

Attempts are made to evaluate the intra-specific relationship between body size and DDT uptake in the mosquito-fish, Gambusia affinis. Carbon-14 labelled p,p'-DDT was used in static bioassays. Gas-liquid chromatography determinations of naturally occurring DDT levels in experimental fish were made. The smallest fish were most efficient at were made. The smallest fish were most efficient at removing DDT from water, with the efficiency diminishing rapidly as the fish increased in weight past 200 mg. Direct absorption of DDT from the water may be more important than magnification via the food chain. (LeGore-Washington)

#### EFFECTS OF SALINITY ON UPTAKE OF DDT, DDE AND DDD BY FISH.

Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.

Philip G. Murphy.

Bulletin of Environmental Contamination and Toxicology, Vol 5, No 5, p 404-407. 1 tab, 9 ref.

Descriptors: \*DDT, \*Chlorinated hydrocarbon pesticides, \*Absorption, \*Path of pollutants, \*Water pollution effects, \*Fish physiology, \*Salinity, Bioassay, Chromatography, Pesticide residues, Pesticide kinetics, Aquatic environment. Identifiers: \*DDE, \*DDD, \*Gambusia affinis,

Mosquito fish, Gas-liquid chromatography

The effects were assessed of salinity on the uptake of DDT residues by the mosquito fish (Gambusia affinis) from pesticide concentrations similar to those of environmental waters. Background levels of DDT, DDE and DDD in experimental fish were determined by gas-liquid chromatography. Ethanol solutions of DDT, DDE and DDD were innoculated into static bioassays, in which salinities of 0.15, 10.0 and 15.0 ppt were tested. Accumulation of these compounds was less at 15.0 ppt, and increased salinity apparently had a greater effect on DDT uptake than on uptake of DDE or of DDD. Possible mechanisms of effect are discussed. (LeGore-Washington) W71-09390

## SOIL USE AND WATER QUALITY - A LOOK

INTO THE FUTURE,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conscrvation Research Div. Frank G. Viets.

Journal of Agricultural Food Chemistry, Vol. 18, No. 5, p. 789-792, May 1970, 1 table, 21

Descriptors: \*Water pollution sources, \*Fertilizers, \*Nutrient requirements, Economic justification, Cost-benefit analysis.

Identifiers: Agricultural Nitrogen Institute, South Platte Valley, Colorado.

Increasing use of commercial fertilizers is being blamed for substantial eutrophication of surface water and nitrate accumulation in ground water. The author maintains that the available evidence on this subject is circumstantial rather than direct. He explains that bans on or regulations of fertilizer use are not justified on the basis of existing information, but regulation on a local option basis along with other nutrient control measures may be needed when the facts become sufficient. (Holmes-Rutgers) W71-09419

## PHOSPHATES IN DETERGENTS AND THE EUTROPHICATION OF AMERICA'S WATERS.

Available from Sup of Doc, US Government Printing Office, Wash DC 20402 Price \$0.40. House Report No 91-1004, twenty-third report by The Comm on Gov't Operations, 91st Cong, 2d Sess (1970). 88 p, 2 fig, 9 tab, 87 ref, 2 app.

Descriptors: \*Eutrophication, \*Phosphates, \*Detergents, \*Pollution abatement, Water pollution effects, Nutrients, Phosphorous, Water softening, Legal aspects, Hard water, Public health, Cost comparisons, Aquatic algae, Grants, Model studies.

Phosphorous pollution causes eutrophication, and over half of the phosphorus pollution in the United States is caused by detergents. In these hearings the detergent industry contended that phosphate detergents did not harm and were essential to maintain cleanliness and sanitation standards, since there was no suitable replacement. Rebuttals to these defenses suggest several alternatives to phosphate detergents. The removal of nutrients from waste detergents. The removal of nutrients from waster waters instead of phosphates from detergents as suggested by the industry, would be costly, slow and create additional pollution problems. The committee concluded that no progress had been made in combating eutrophication from detergents and recommended a series of gradual reductions in the use of phosphate detergents, with a complete elimination of their use by the end of 1972. Addi-tionally, the committee recommended: the manda-tory labeling of phosphate content during the in-terim period, expanded research by the Federal Water Quality Administration to develop lowphosphorus or phosphorus-free detergents, and the immediate elimination of the Industry-Government Task Force, whose actual purpose was to secure government cooperation in retaining phosphate detergents. (See also W71-09430) (Gallagher-Florida) W71-09429

#### PHOSPHATES IN DETERGENTS AND THE EUTROPHICATION OF AMERICA'S WATERS. Available from Sup of Doc, US Government Printing Office, Wash DC 20402 Price \$1.25. Hearings--Subcomm on Conservation and Natural Resources--House Comm on Gov't Operations, Dec 15 and 16, 1969, 91st Cong, 1st Sess, 1970. 318 p, 2 fig, 47 tab, 2 chart, 110 ref, 3 app.

Descriptors: \*Eutrophication, \*Phosphates, \*Detergents, \*Water pollution sources, Phosphorus, Sewage treatment, Municipal wastes, Environmen-Sewage treatment, Municipal Wastes, Environmental sanitation, Technical feasibility, Economic feasibility, Administrative agencies, Federal government, Legal aspects, Waste water treatment, Industries, Abatement, Water quality control.

Numerous statements and documents on diverse aspects of phosphate detergents and the effect of phosphates in the eutrophication of America's waters were presented. Representatives of the Soap and Detergent Association presented the detergent industry's position. Testimony was also received from: (1) the Institute of Water and Air Pollution in Stockholm, Sweden; (2) Water Pollution Stockholm, Sweden; (3) the Commissioner of the Federal Water Pollution Control Administration; (4) Eldib Engineering and Research, Inc.; (5) the Great Lakes Institute; (6) the Assistant Secretary of the Interior for Water Quality and Research; (7) the Center for Urban Studies of the University of Chicago; (8) the Eutrophication Information and Water Resources Centers of the University of Wisconsin; and (9) the Joint Industry-Government Task Force. The testimony dealt with such topics as: (1) the present feasibility of eliminating the use of phosphate detergents, (2) the sources of phosphorous input, (3) information concerning all federal grants or contracts for phosphate removal, (4) problems of removing phosphates from municipal sewage, (5) alternatives to phosphate detergents, and (6) measures taken by the Joint Industry-Government Task Force. (See also W71-09429) (Gallagher-Florida) W71-09430

## 1969 FISH KILLS CAUSED BY POLLUTION (STATISTICAL REPORT).

For primary bibliographic entry see Field 05B.

#### Waste Treatment Processes—Group 5D

W71-09441

NUTRIENT REMOVAL AND ADVANCED WASTE TREATMENT.
Pittsburg Univ., Pa. Graduate School of Public

Health.

For primary bibliographic entry see Field 05D. W71-09450

#### **5D. Waste Treatment Processes**

TESTING AND EVALUATION OF OIL SPILL RECOVERY EQUIPMENT.

Main Port Authority, Portland. For primary bibliographic entry see Field 05G. W71-08942

## ROTATING BIOLOGICAL CONTACTORS FOL-

LOWING ANEROBIC LAGOONS, lowa Beef Processors, Inc., Dakota City, Nebr. Jimmie A. Chittenden, and W. James Wells, Jr. Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 746-754. 4 fig, 4 tab.

Descriptors: \*Industrial wastes, treatment, Slime, Biochemical oxygen demand, Dissolved oxygen, Weirs, Oxidation, Hydraulics, \*Anaerobic conditions, Aerobic conditions, Aeration, Design flow, Temperature, Odor, Iowa, \*Oxidation lagoons, Biological treatment.

Identifiers: Rotating biological contactors, \*Meat

packing wastes.

An aerobic biological contactor, in the form of a rotating disc pilot plant, was used to stablize the effluent from an anaerobic lagoon used for treating meat packing wastes. A hydraulic loading of 8.0 of the rotating disc contactor. Under these conditions, no detectable DO was present in the effluent from any of the stages. BOD reduction in the first stage was 42.5% and only 50.2% for all three stages based on settled BOD values. For the second test run, the rotational speed of the discs was increased from 3-6 rpm. DO was still detected only occasionally, while first stage BOD reduction averaged 52.5% and 65.4% was the average for the overall system. For the final test, the flow rate was cut in half. There was a DO concentration range of 0.9-1.5 mg/l in the effluent from the first stage which persisted through the unit. BOD reduction for the first stage was 79.5% and overall BOD reduction was 88.2%. From these results, a one stage rotating disc contactor loaded at a rate of 4 gpm/ft2 of contactor area was determined to provide optimum treatment. This system facilitates odor control, and also provides inexpensive efficient treatment. (Lowry-Texas) W71-08943

#### EFFECTS OF CONTAMINANTS ON REAERA-TION RATES IN RIVER WATER,

Illinois State Water Survey, Peoria. For primary bibliographic entry sec Field 05G. W71-08944

#### COMBINED SEWER REGULATION WITH FLUIDIC REGULATION,

Bowles Fluidics Corp., Silver Spring, Md. For primary bibliographic entry see Field 05G. W71-08948

## WASTE WATER FROM SIMIAN PRIMATE

Tulane Univ., Covington, La. Delta Regional Primate Research Center.

E. W. Fritschi, and F. W. Macdonald.

Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 883-889.

Descriptors: \*Laboratory animals, \*Waste water treatment, Design criteria, Sampling, Analytical techniques, Evaporation, Biological oxygen demand, Urine, Coliforms, Pathogenic bacteria, Animal parasites, Disinfection, Chlorination, Louisiana, \*Treatment facilities.
Identifiers: \*Primates, \*Bacteriological analyses,

Water and waste water balances were performed on the Delta Regional Primate Research Center in Covington, Louisiana. Total input of both food and water was measured for selected animals and urine, feces, and vomitus of the animals were also collected and analyzed. Average food consumption was 3.0% of body weight, and an estimated 50% of the food is wastes. Measurement of the BOD of the collected waste materials established primate wastes as being 3 to 6 times higher in BOD than conventional municipal wastes. No correlation of total solids with genera, age, weight, or sec of the animals was discovered. Primate feces were found to be cruder than human feces, also and considerable difficulty in finding a suitable feed for the diluble difficulty in finding a suitable feed for the dilu-tion water. Further study of this phenomenon has been planned. Monitoring of daily water usage revealed a fairly constant flow. There was little daily fluctuation in cage washwater, since the animal population was fairly constant, and all cages had to be washed. Bacteriological analysis revealed a wide variety of organisms including several non-specific parasites and numerous pathogens. This discovery neccessitated that particular attention be discovery neccessitated that particular attention be given to chlorination and disinfection. (Lowry-Tex-W71-08949

#### WATER RECLAMATION AND ALGAE HAR-VESTING,

Asian Inst. of Tech., Bangkok (Thailand). M. G. McGarry, and C. Tongkasame.

Journal Water Pollution Control Federation, Vol
43, No 5, May 1971, p 824-835. 9 fig, 3 tab, 9 ref.

Descriptors: \*Ponds, \*Water reuse, Reclamation, Algae, Protein, \*Oxidation lagoons, Climatic zones, Precipitation, Coagulation, Lime, Hydrogen ion concentration, Temperature, Chlorination, Floatation, Dewatering, Drying, Cost analyses, Waste water treatment.
Identifiers: \*Algae harvesting.

Application of high rate oxidation ponds equipped with algae harvesting may help to augment the dwindling water supplies of large metropolitan areas by reclaiming waste water for varied uses, while at the same time producing a usable algal feed supplement. Conditions for optimal operation include: (1) 200 lb BOD/acre/day; (2) 17.7 in. depth; and (3) 1 day detention time. Ponds operated in this manner provide an average effluent BOD (after algae removal) of less than 10 mg/l, and one acre of pond can produce 100,000 lb per yer of algae containing 60% protein. Chemical coagulation and precipitation chemicals studied included lime, alum, and 50 different polyclectrolytes. Polycations were found to be most economic, but usage of polyelectrolytes as aids contributed a greater chemical cost than usage of alum along at pH 6.5. The downflow solids contact system was examined for removal of the algae, either by the split flow, dissolved air, or supersaturated oxygen principles. The algal paste was sun dried on undrained flat plates, to less than 10% moisture. At solar energy levels of 480 g cal/sq cm/day, 2800 lbs/day of dried algae could be processed on one acre. The results of the investigations were incorporated into an urban model which includes recycling of clarified pond effluent for household cleaning purposes. A 67% reduction in raw water needs was predicted for such a system, but much further investigation and refinement is necessary. (Lowry-Texas) W71-08951

ORGANIC DESORPTION FROM CARBON-I A CRITICAL LOOK AT DESORPTION OF UNKNOWN ORGANIC MATERIALS FROM CAR-BON,

Missouri Univ., Rolla. S. C. Allen, R. H. Pahl, and K. G. Mayhan.

Water Research, Vol 5, No 1, Jan 1971, p 3-18. 13 fig, 4 tab, 17 ref.

Descriptors: \*Activated carbon, Freeze drying, Vacuum drying, Evaporation, Temperature, Mixing, Separation techniques, Analytical techniques, Chromatography, Spectrophotometry, Filtration, Instrumentation, \*Organic compounds, Waste water treatment.

Identifiers: \*Desorption, \*Standard CCE method, Choroform, Thermocouple.

Before desorption of organic materials from carbon can be accomplished, the carbon must be dried as completely as possible. Laboratory analyses have established that the amount of residual moisture remaining in dried carbon is a function of the method used for drying. In particular, freeze drying leaves less residual moisture than rotary evaporation, which leaves much less residual moisture than air drying. The Standard drying procedures adopted by the American Public Health Association led to wide variations in results, and some modifications are necessary before reproducible results can be obtained from separate investigators. The carbon chloroform extraction method was also subjected to laboratory scrutiny. The specified operating procedure is subject to wide variation in interpretation, to such an extent that reproducibility of results of different investigators is almost nonexistent. The Soxhlet extraction efficiency is affected by the moisture content, and the variability of the moisture content has already been established. Thermal degradation of certain orcatalogue Thermal degradation of Certain organics may also occur as a result of high pot wall temperatures produced by the heating mantle. Therefore, although the ideas behind the tentative Standard CCE Method are sound, the non-specific nature of the operating conditions may introduce considerable error when considered on an abolute basis. (Lowry-Texas) W71-08956

# THE EFFECT OF CELL RE-CYCLE ON ACTIVATED SLUDGE PROCESS OPERATION, California Univ., Davis. Dept. of Civil Engineering.

E. D. Schroeder.

Water Research, Vol 5, No 1, January 1971, p 29-39. 9 fig, 7 ref.

Descriptors: \*Activated sludge, \*Kinetics, Biodegradation, Mixing, Aeration, Organic loading, Analytical techniques, Mathematical models, \*Wastewater treatment, Biological treatment, Cytological studies.

Identifiers: Re-cycle cell concentration, Plug flow, Residence time.

Conventionally Conventionally designed activated sludge processes are currently operating in a range bounded by ideal plug flow and ideal stirred tanks, with completely mixed systems approaching the ideal stirred tanks in operational characteristics. In all cases, trade-offs occur between growth rate (and corresponding bio-oxidation rate), recycle ration, and recycle cell concentration. Recycle cell concentration increases result in increases in reacconcentration increases result in increases in reactor cell concentration, for a given recycle ratio, and also a decrease in the residence time necessary to remove a given amount of organic material. The necessity for high recycle cell concentrations establishes the importance of the secondary clarifier to the system. On a general basis, usage of low secondary clarifier overflow rates would probably mean fewer operational difficulties with the activated sludge process. The most important factor directly concerned with recycle, however, is that recycle and cell concentration ratios directly influence the observed growth rate which alters the actual kinetic processes. The effect of recycle must therefore, be included in field data in order for such data to be reliable. (Lowry-Texas)

## OCCURRENCE OF FILAMENTOUS MICROORGANISMS IN ACTIVATED SLUDGE,

Wisconsin Univ., Madison. Dept. of Civil Engineer-

ing. G. J. Farquhar, and W. C. Boyle.

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5D—Waste Treatment Processes**

Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 779-787. 28 fig, 1 tab, 19

Descriptors: \*Activated sludge, \*Microorganisms, Organic loading, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Municipal wastes, Sphaerotilus, Isolation, Aeration, Chlorination, Waste water treatment, Wisconsin. Identifiers: \*Sludge bulking, \*Filamentous microorganisms, Lactic acid bacteria, Bacterial physiology.

Samples of activated sludge taken from waste water treatment plants in Southern Wisconsin were analyzed by microbiological techniques, and 17 different types of filamentous micro-organisms were found to be present. The source, date of collection, round to be present. The source, date of conection, extent of growth, sludge volume index (SVI), and the mixed liquor suspended solids (MLSS) concentration were recorded for each organisms studied. Thiothrix, Sphaerotilus, lactic acid bacteria, Toxothrix, and Vitreoscilla, having been previously documented as suspected causative agents of sludge bulking, were closely scrutinized. Past dif-ficuluties in determining which organisms were ac-tually present in a sample, due to lack of both facilities and trained personnel, have led to many incon-sistencies in previous data. Although exact identifi-cation was not possible for individual organisms in most cases, filamentous microorganisms in general have been recognized as contributors to the bulking problem. In most instances, filamentous organbecome entangled with the flock particles creating a bridging effect, so that the floc moves as a mass, and this factor was recognized as leading to poor dewatering characteristics. At present, raw waste water and return sludge chlorination, return sludge reaeration, sludge loading rate reductions, mixed liquor DO adjustments, and preaeration of raw waste water have all been employed to stop sludge bulking. However, since each filamentous organisms responds differently to the control measures, identification is essential to selection of the correct remedial action, eliminating trial and error measures which may make conditions even worst. (Lowry-Texas) W71-08958

# ANAEROBIC STABILIZATION OF POTATO PROCESSING WASTES AS AFFECTED BY ORGANIC LOADING RATE,

Idaho Univ., Moscow. Dept. of Chemical Engineer-

ing.
A. T. Wallace, D. W. Siddoway, and M. L. Jackson. Idaho University Engineering Experiment Station, Research Report No 9, Jan 1970. 28 p, 3 fig, 7 tab,

Descriptors: \*Industrial wastes, \*Anaerobic digestion, \*Organic loading, Hydrogen ion concentration, Chemical oxygen demand, Temperature, Alkalinity, Methane, Carbon dioxide, Nutrients, Sampling, Monitoring, Automatic control, \*Waste water treatment, Idaho.

Identifiers: \*Potato processing wastes, Volatile acids, Rate constants, Detention times.

Laboratory scale reactors were constructed to determine the treatability of potato processing wastes by anaerobic stabilization. The temperature was fixed at 35 deg C, the residence time of 5 days, and the feed COD levels were 2,000, 4,000, 10,000, and 20,000 mg/l. Efficiency of treatment was determined on the basis of: (1) the reduction in the level of COD between the feed and effluent streams; (2) the methane: carbon dioxide ratio in the effluent gas; and (3) the rate of gas production. From these investigations it was determined that: (1) volumetric efficiency of COD reductions increased linearly with increased volumetric loadings; (2) % COD reduction was nearly constant for a wide range of organic loadings; (3) an anaero bic reactor operated at a 5 day detention time and 35 deg C will stabilize 60% of the COD at loading up to and possibly greater than 20,000 mg/l; (4) increased loadings decrease reactor stability making continuous pH monitoring and control essential for a full-scale reactor; and (5) the biochemical reactions involved had an average pseudo-first order rate constant of .244 days-1, with a range between .150 days-1 and .354 days-1. Further study over a wider range of temperatures, detention times, and organic loadings is necessary to establish characteristics of failures. (Lowry-Texas)

## SOME PROBLEMS OF INDUSTRIAL WASTE DISPOSAL FROM A FERTILIZER PLANT,

Electric Reduction Co. of Canada Ltd., Toronto (Ontario).

J. H. Forster.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 6-17. 2

Descriptors: \*Phosphates, \*Sedimentary rocks, \*Fertilizers, \*Industrial wastes, Gypsum, Fluorides, Sedimentation, Lagoons, Neutralization, Lime, Slurries, Hydrogen ion concentration, Maintenance, Flow rates, Water reuse, Cost analysis, Evaporation, \*Waste water treatment, Waste disposed disposal.

The two major pollutants in effluents from phosphate-containing fertilizer plants are fluorides and gypsum. The fluorides are present as 3 to 4% by weight of the phosphate rocks which are used to produce phosphates. The gypsum is produced in acid splitting of the phosphate from the phosphate rock and is collected as filter cake. Gypsum is formed at a rate of 1.5 to 1.6 tons per ton of rock digested, or 4.6 to 5.2 tons per ton of P sub 2 O sub 5 produced. Total effluent flow averages 3500 IGPM, and contains 27TPD P sub 2 O sub 5, 68. 7TPD fluorides, and 2400 TPD gypsum. This effluent is treated with lime to neutralize the P sub 2 O sub 5 and flurorides, settled to remove the precipitated phosphates and fluorides along with the by-product gypsum, and discharged into the Grand River after clarification. Recurring problems with operation and maintenance led to the construction of a \$270,000 addition to recycle the plant water. Significant operation and maintenance savings are being realized, and effluent flow has been reduced from 3000 to 4000 IGPM to approximately 200 IGPM. (Lowry-Texas) W71-08961

#### UTILIZATION AND STABILIZATION OF

SOLID WASTES, Bureau of Mines, Salt Lake City, Utah. Salt Lake City, Metallurgy Research Center. K. C. Dean, R. Havens, and E. G. Valdez. Proceedings, Ontario Industrial Waste Conference. 16th, June 1969, Niagara Falls, Ontario, p 18-42.

Descriptors: \*Solid wastes, \*Industrial wastes, Waste dumps, Cost analysis, Economic feasibility, Technical feasibility, Vegetation establishment, Stope stability, Bank stability, Erosion, Fertilization, Nitrogen, Phosphates, Leaching, Metals, Toxicity, Hydrogen ion concentration, Solubility, Slimes, Dewatering, Salinity, Germination, Radiation, Percolation, Osmotic pressure, Utah, Waste disposal, Waste water treatment.
Identifiers: \*Salt Lake City, Waste recovery.

Expansion of the population is rapidly eliminating isolated areas. These areas, many of which had formerly been used as dumping grounds for waste products because of their isolation, must now be redecorated and their original natural beauty restored. Utilization and reclamation studies have been initiated to discover: (1) methods of producing copper from dump leach solutions using shredded auto soap as a cementation medium; (2) ways of recovering zinc from foundry dusts; (3) methods of recovering additional values from copper and uranium mill wastes; and (4) procedures for the production of ceramic and construction materials from waste products. Stabilization studies using physical, chemical, vegetative, and combination techniques have also been made in attempts to convert ugly slag piles to more attractive vegetation areas. Tables on costs are

presented for the various methods. In the case of stabilization, costs for a combination stabilization were reported at \$136 per acre. Further extensive economic and technological feasibility studies are continuing. (Lowry-Texas) W71-08962

#### TREATMENT OF BRASS MILL EFFLUENTS AT ANACONDA TORONTO PLANT,

Anaconda American Brass Ltd., Toronto (On-

J. J. McGrath.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 82-89.

Descriptors: \*Industrial wastes, \*Acids, Neutralization, Hydrogen ion concentration, Lime, Flocculation, Coagulation, Water re-use, Oxidation-reduction, Coagulation, Water re-use, Oxidation-reduc-tion potential, Copper, Iron, Chemical precipita-tion, Cost analysis, Pumps, Sludge, Baffles, Storage, \*Waste water treatment. Identifiers: \*Pickle liquor, Equalization, Toronto,

A waste water treatment plant, consisting of a col-lection sump, an equalization basin, iron contact launders, copper settling pits, a clarifier, a thickener tank, and a control building, was constructed at a cost of \$750,000 to treat spent acids from a brass mill. Dumping volume of spent acid solutions averages 3500 cu ft annually, while 1300 cu ft of dichromate is dumped per week. Copper recovery is practiced in the iron launders and the copper settling tanks. Approximately 5 tons of scrap iron tube are used per month to form 5 tons of copper cementate from which copper metal is recovered. Sulfur dioxide is available to assist in the reduction in the iron launders, but because of the use of shorter lengths of iron tube, and greater turbulence, the sulfur dioxide is only a supplementary protection. 22 tons of hydrated lime are used each month both for pH control and coagulant aid. 5 lbs 10 oz. of coagulant aid X 1633 are also used daily to reduce the pinpoint floc escaping in the effluent. Treated effluent is re-used as cooling water in the plant. Efforts are continuing in the hope of discovering new and better chemicals for coagulation and neutralization developing improved recovery techniques, and finding a market for 28 tons per month of filter cake sludge. (Lowry-Tex-

as) W71-08963

#### THE TREATMENT OF LIQUID WASTES FROM AN AUTOMOBILE MANUFACTURING OPERA-TION,

General Motors of Canada Ltd., St. Catharines (Ontario).

J. A. Watson.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 90-98.

Descriptors: \*Industrial wastes, \*Domestic wastes, Cooling water, Storm run-off, Sewers, Analytical techniques, Water pollution control, Neutraliza-tion, Sedimentation, Flocculation, Coagulation, Hydrogen ion concentration, Lime, Oil, Flotation, Incineration, Sampling, Turbulence, \*Waste water

Identifiers: St. Catharines (Ontario).

The Windsor, Ontario plant of General Motors of Canada Ltd. placed the Windsor Treatment Plant on stream in September 1968, approximately 3 years after the initial survey of the waste discharge problem. Technical expertise in the selection and design of the plant was provided at all levels by G.M. engineers who had already experienced this type of work, in their own plants or elsewhere. The installation of a major waste treatment plant at an existing factory is both disruptive and expensive from the plant standpoint. For this particular case, separate sewer lines were built to segregate the three main flows of sanitary wastes, cooling and storm water, and industrial wastes, rather than undertake a major revision of the existing collection system. For the prevention of accidental discharges

ill floor drains were provided with a single outlet only at the industrial waste treatment plant. Treatment facilities include flocculation and flotation for oil and suspended solids removal, with discharge of Silvand suspended sonds removal, with discharge of sludge to an incinerator, and supernatant to the Windsor sewerage system. This system will serve as a pattern for future waste treatment facilities for GM's Canadian plants. (Lowry-Texas) W71-08964

# REMOVAL OF PHENOL AND THIOCYANATE FROM COKE PLANT EFFLUENTS AT DOFASCO, Dominion Foundries and Steel Ltd., Hamilton (On-

James E. Ludberg, and G. Donald Nicks.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 99-110.

Descriptors: \*Phenols, \*Industrial wastes, Biodegradation, Activated sludge, Aeration, Ox-ygenation, Nutrients, Phosphates, Nitrogen, Temperature, Hydrogen ion concentration, Neutraliza-tion, Ammonia, Waste dilution, Sedimentation, Analytical techniques, Foaming, Instrumentation, \*Waste water treatment. Identifiers: \*Cyanide.

Flushing liquor from a coking process contains, on the average, 3400 ppm COD 2010 ppm total ammonia, 185 ppm thiocyanate and cyanide as CNS, 1100 ppm total phenols, and 750 ppm of monohydric phenols, while pH averages 8.8. The three methods of treating phenolic wastewaters include: (1) evaporation; (2) solvent extraction; and (3) bacteriological treatment. Since evaporation of phenolic compounds pollutes the air and corrodes the surrounding area, and the solvent extraction process both costs more and removes less phenol, the bacteriological process was selected to treat the 75,000 gallons of liquor produced daily. The plant includes a storage tank, a two compartment aeration tank, settling tank, innoculum tank, and a steel pump and electrical control housing. Design capacity is 133,000 IGPD which requires a 1:1 dilution before entering the aeration tanks. Addition of phosphate is also essential for good biological growth. Start-up difficulties are included in the discussion along with the measures taken to alleviate them. Since start-up, not more than 1 hour per day of maintenance has been required, although 3 hours/day of laboratory time are required for analyses, and 6 hours/day of operator time are required for adjustments. Daily electrical requirements have averaged 1320 KWH, and daily phosphate cost is \$12.00. (Lowry-Texas) W71-08965

#### OXIDATIVE ASSIMILATION OF NITROGEN-DEFICIENT INDUSTRIAL WASTE,

Oklahoma State Univ., Stillwater. A. F. Gaudy, and K. C. Goel.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 111-123. 5 fig, 10 ref. USDI Research Grant WP-00325.

Descriptors: \*Industrial wastes, \*Nitrogen, Nutrients, Phosphorus, Chemical oxygen demand, Biochemical oxygen demand, Pilot plants, Aeration, Hydrogen ion concentration, Temperature, Carbohydrates, Kinetics, Carbon, Sludge, \*Waste water treatment.

Identifiers: \*Oxidative assimilation, \*Endogeneous aeration, Glucose, Supernatant.

Batch and pilot plant studies utilizing a synthetic carbohydrate waste, a synthetic non-carbohydrate waste, and a nitrogen deficient industrial effluent were performed to determine the feasibility of treating nitrogen deficient wastes. Present practice included nitrogen addition before the aeration tank. The kinetics of the process precluded immediate utilization of the nitrogen, which subsequently passed through and into the effluent. However, by allowing the reaction to proceed

under nitrogen deficient conditions, oxidative assimilation removed organic material as stored carbon, which was then reacted with nitrogen during endogenous respiration. Test results showed no leakage of nitrogen to the effluent, and also verified that less nitrogen would be required. The process operated satisfactorily at COD/N ratios of as high as 70 to 1 for the synthetic wastes. This cor-responded to more than twice the conventional BOD to N ratios. Further experimentation at plants with this type of waste is needed. Optimum detenwhite this type of waste to recover symmetric tion times in the feeding and endogenous aerators, optimum recycle solids levels, and the limiting BOD to N ratio have yet to be determined. Although this procedure deviates considerably from standard practice, its benefits are obvious, and it is to be hoped that operating personnel interested in reducing costs and stream enrichment will experiment with it. (Lowry-Texas) W71-08966

## TREATABILITY STUDIES FOR INDUSTRIAL

WASTES, Prosearch Ltd., Oakville (Ontario). Robert W. Slater, and Frank Guillame.
Proceedings, Ontario Industrial Waste Conference,
16th, June 1969, Niagara Falls, Ontario, p 124140. 15 fig, 1 ref.

Descriptors: \*Treatability studies, \*Industrial wastes, \*Design criteria, Biochemical oxygen demand, Aeration, Oxygenation, Sludge, Mixing, Organic loading, Microorganisms, Activated sludge, Pilot plants, Analytical techniques, Cost analysis, Flexibility, Lagoons, \*Waste water treatment. Identifiers: \*Suspended solids, Oakville (Ontario).

Many references contain design criteria which are geared to the average industrial waste of a paper mill, or a chemical plant, etc. However, not only do these criteria lack validity, but the analytical tests upon which they were based are also invalid. Suspended solids and BOD5 are both outdated parameters which must be replaced by particle size characterization and carbon balances respectively, before any progress can be made in achieving true optimal designs. Three case histories are presented, including graphs of both the values expected by conventional design, and the values obtained by using equipment which simulates the actual components. In addition, the variability of industrial processes necessarily leads to a variability of the wastes produced. Changes in production technology may cause the type of waste discharged to literally change overnight. Treatability studies will safely predict the effect of such changes before they are allowed to upset the plant and jeopardize the receiving waters. In this manner, the cost effectiveness of different unit operations can also be evaluated so that more rational decisions and designs will result in cleaner water at less cost to both the populace and the industry. (Lowry-Texas) W71-08967

## GRASS FILTRATION-POND STABILIZATION OF CANNING WASTE, A TWO-STEP PROCESS,

Canadian Canners Ltd., Hamilton (Ontario).

T. G. Stevens, and G. G. Dunn.

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, p 161-175. 9 fig, 4 tab.

Descriptors: \*Sprinkler irrigation, \*Return flow, \*Canneries, Industrial wastes, Fruit crops, Strawberries, Peaches, Oxidation lagoons, Screens, \*Filtration, Run-off, Evaporation, Percolation, Organic loading, Temperature, Biochemical oxygen demand sub 5, Sampling, Pilot plants, Biodegrada-tion. \*Waste water treatment. Identifiers: St. Davids (Ontario), Canada.

The St. Davids plant of Canadian Canners Ltd. has been in continuous operation since 1896. The processing season begins in mid-June with strawberries, and runs through cherries, apricots, plums and peaches, finishing with pears in late November, with a total processing throughout of 8,000 tons of

fresh fruit. Previous treatment consisted of holding the processing waste water in a lagoon over the winter and dumping it into the creek during the Spring thaw when creek flow was maximum. Irrigation was begun in 1958 with a 40 acre field which by 1965 had grown to a 140 acre field which was still too small. A pilot scale study of a series of 5 oxidation ponds was conducted with disappointing results. Finally, it was decided to combine the two systems, with the effluent being irrigated onto the land, and the run-off flowing into a series of stabilization lagoons. An experimental pond measuring 800 ft x 550 ft with a 5 ft depth, was constructed. Since the run-off from the field had BOD structed. Since the run-off from the field had BOD sub 5 only 10% of that of the raw waste, the stabilization pond was subjected to light organic loading and functioned well. No cost estimates are available for this system, but it seems to be relatively inexpensive. Work is continuing in an attempt to provide a by-pass directly from the plant to the stabilization pond to prevent large volumes of rainwater from entering the system. (Lowry-Texas) W71-08968

# PRE-TREATMENT OF WASTES AT BARRIE TANNING LIMITED, BARRIE, ONTARIO, Gore and Storrie Ltd, Toronto (Ontario).

Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 176-

Descriptors: \*Industrial wastes, \*Organic loading, Biochemical oxygen demand, Hydrogen ion concentration, Sludge, Odors, Temperature, Screens, Aeration, Sedimentation, Anaerobic digestion, Dewatering, Maintenance, Cost analysis, \*Waste water treatment.

Identifiers: \*Tannery wastes, \*Pre-treatment, Suspended solids, Barrie (Ontario).

The treatment plant of the city of Barrie experienced problems including: (1) operational problems in treatment due to extremely high and variable BOD loads; (2) high suspended solids loads resulting in sludge handling problems; (3) odor problems; and (4) excessive maintenance of the sewer downstream of the tannery. A comprehensive program of water conservation was employed at the tannery, resulting in a 30% reduction of the waste flow. The daily volume of waste to be handled stabilized at 185,000 gallons. The plant was designed for primary treatment only, including screening flow equalization, pre-aeration, settling, sludge removal and storage, scum removal, flow metering, tank truck removal of scum and sludge, and dewatering. Limits established for the effluent were: (1) 300 ppm BOD; (2) 350 ppm suspended solids; (3) 100 ppm ether solubles; and (4) pH range of 5.5 to 9.5. From the limited data available so far, for BOD and SS the ranges are from 290 to 600 ppm and 300 to 760 ppm respectively in the effluent. Total cost of this installation was \$195,000, with financing arranged by the city. Much improvement in the city treatment plant has been noted, with a reduction in sludge haulage from 15 to 5 truck loads per day. Studies are continuing in the areas of chemical coagulation, sludge concentration, and odor removal. (Lowry-Texas) W71-08969

## TREATMENT OF POTATO PROCESSING WASTES AT SALADA FOODS LTD., AL-LISTON, Ontario Water Resources Commission, Toronto.

T. D. Armstrong, and B. I. Boyko.
Proceedings, Ontario Industrial Waste Conference, 16th, June 1969, Niagara Falls, Ontario, p 188-

Descriptors: \*Potatoes, \*Industrial wastes, Screens, Sedimentation, Organic loading, Activated sludge, Aeration, Dissolved oxygen, Sludge, Oxidation lagoons, Algae, Administration, Maintenance, \*Waste water treatment. Identifiers: \*Potato processing wastes, Aerobic

lagoons, Anaerobic lagoons.

### **Group 5D—Waste Treatment Processes**

The Salada Plant at Alliston, Ontario, was constructed in 1959. At this time, 5000 lbs/hr of potatoes were processed into potato flakes during a 24 hour day. Since that time new products have been added, and water consumption, initially 200,000 gpd now ranges from 630,000 to 750,000 gpd during the August to May processing season. The Company and the town were to construct secondary treatment facilities jointly. The initial installation was designed for a waste flow of 150,000 gpd and included screening, sedimentation, an anaerobic lagoon, and two aerobic lagoons. The lagoon filled for 5 1/2 months, and effluent on the first day of overflow was 376,000 gallons with corresponding 6010 lbs BOD. The plant was overloaded both hydraulically and organically, the anaerobic lagoon was changed to an aerobic lagoon, two concrete clarifiers were added, each with 2.75 hours detention time, and bubble gun aeration devices were installed. Since the plant was still over-loaded, a comprehensive survey was ordered, and from the results of this study, a 6.2 hour detention time activated sludge basin was built. Total cost of the treatment plant had risen to \$350,000. Although problems were still encountered, this treatment facility provided adequate treatment. Had the necessary long range planning been done earlier, a serious pollutional problem may have been avoided. (Lowry-Texas)

## GRANTS FOR CONSTRUCTION OF TREATMENT WORKS.

For primary bibliographic entry see Field 06E. W71-08980

## SIMULATION OF AMMONIA STRIPPING FROM WASTE WATER,

Environmental Protection Agency, Cincinnati, Ohio. Water Quality Office.

Joseph F. Roesler, Robert Smith and Richard G. Filers

Journal of the Sanitary Engineering Division, ASCE, Vol 97, SA 3, Proc Paper 8182, p 269-286, June 1971. 18 p, 10 fig, 1 tab, 19 ref, 2 append.

Descriptors: \*Cooling towers, \*Sanitary engineering, \*Sewage treatment, Computers, Cost analysis, Reclamation, Water temperature, Waste water treatment.

Identifiers: \*Ammonia stripping, Henry's law.

A computer program that can be used for the design and simulation of ammonia stripping and film packed cooling towers was described. The ammonia stripping portion of the program was embedded in the cooling tower circulation in order that the variation of Henry's Law constant with water temperature could be taken into account. The logic of the program was arranged for: (1) Design of cooling towers; and (2) for design of ammonia stripping towers with temperature correction. Two tower configurations were included in the program: (1) Countercurrent in which the liquid flows down and the air moves upward; and (2) Crosscurrent in which the liquid flows down and the air moves horizontally at right angles to the flow of the liquid. Regression equations relating the height of a transfer unit and gas and liquid flow rates were developed from pilot and full scale plant data. Detailed capital and operating cost data were taken from the literature. The computed results indicated that for a crossflow tower an optimum gas to liquid ratio is about 1.75, and for counterflow the optimum is at about 4. Relations between the height of the tower percent removal, cost and influent flow were also examined. It was shown that the total treatment cost levels off between 7 mgd and 10 mgd. (Veverka-Cornell) W71-08998

PYRITE DEPRESSION BY REDUCTION OF SOLUTION OXIDATION POTENTIAL.
Utah Univ., Salt Lake City. Dept. of Mineral Engineering

Copy available from GPO Sup Doc, \$0.70; microfiche from NTIS as PB-200 257, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series Report, December 1970. 50 p, 18 fig, 4 tab, 29 ref. EPA Program 12010 DIM 08/70.

Descriptors: \*Separation techniques, \*Pyrite, \*Flotation, \*Reduction (Chemical), Water pollution control, Oxidation-reduction potential, Sulfates, Sulfides, Mining, Acid mine water, Mine wastes, Poisons.

Identifiers: \*Mineral separation techniques, Cyanide

A study of pyrite depression by reducing agents with potassium ethylxanthate as collector indicates that pyrite may be depressed effectively in the flotation of both lead and copper sulfide ores without the use of poisonous cyanide salts. More specifically, the use of sodium sulfite as the depressant may result in metallurgical, economical, environmental and safety advantages over the poison, cyanide. For example, in the case of the copper ore, the best results with cyanide as the depressant were a rougher concentrate recovery of 90.2% and a grade of 4.3% Cu. However, when sulfite was used as the depressant for the same recovery a grade of 7.3% Cu was obtained. (Knapp-USGS) W71-09078

ANIMAL SLAUGHTERING AND PROCESSING. For primary bibliographic entry see Field 06E. W71-09209

## REGIONALLY CONSOLIDATED INDUSTRIAL WASTE WATER TREATMENT.

For primary bibliographic entry see Field 06E. W71-09210

# BEHAVIOR OF NATURAL RADIOACTIVE ELEMENTS IN STANDING RESERVOIRS, A. A. Iskra, N. V. Kulikov, and V. G. Bakhurov.

A. A. Iskra, N. V. Kulikov, and V. G. Bakhurov. Trans from Atominaya Energiya. Soviet Atomic Energy, Vol 27, No 2, p 134-137 (1969). 2 tab, 12 ref.

Descriptors: \*Radioactive wastes, \*Mine wastes, \*Radioactive waste disposal, Uranium radioisotopes, Radium radioisotopes, Lead radioisotopes, Treatment, Water pollution sources, Aquatic plants, Absorption, Detritus, Sedimentation, Lake soils, Aquaria, Biological treatment, Ecology, Soil-water-plant relationships. Identifiers: Thorium radioisotopes.

Four types of simulated reservoir system were studied through experiments performed in 10 liter glass flasks: (1) lake water, (2) lake water plus soil, (3) lake water plus soil plus aquatic plants, (4) lake water plus plants. The predominant buildup of uranium occurred in plant materials, that of thorium occurred in debitus and soil, and that of radium in plant materials. The greatest specific activity and buildup capability is possessed by detritus; to a lesser extent, by plants; and to an insignificant degree, by soil. These results may find practical application for secondary purification of liquid radioactive wastes in artificial storage ponds in which (as a supplement to the main process of sedimentation) uptake of radionuclides by certain types of aquatic plants is used. (Bopp-NSIC) W71-09243

# BIOCHEMISTRY AND PHYSIOLOGY OF DENITRIFICATION BY MARINE BACTERIA, Georgia Univ., Athens. Dept. of Microbiology. W. J. Payne.

Available from the National Technical Information Service as AD-721 113, \$3.00 in paper copy, \$0.95 in microfiche. ONR Final Project Report, 19 Mar 71, 19 p. ONR Project Nonr 3677 (01).

Descriptors: \*Bacteria, \*Nitrogen fixing bacteria, \*Denitrification, \*Marine microorganisms,

Anaerobic conditions, Aquatic microbiology, Cytological studies, Metabolism, Pseudomonas. Identifiers: Marine biology, Respiration, Oxidation-reduction reactions, Nitrogen, \*Anaerobic processes.

P. perfectomarinus was found to grow anaerobi-cally at the expense of nitrate, nitrite or nitrous oxide but not chlorate or nitric oxide. In several repetitive experiments, anaerobic incubation in culture media containing nitrate revealed that an average of 82% of the cells in aerobically grown populations were converted to the capacity for respiration of nitrate. Although they did not form colonies under these conditions, the bacteria synthesized the denitrifying enzymes within 3 hr in the absence of oxygen or another acceptable inorganic oxidant. This was demonstrated by the ability, after anaerobic incubation, of cells and extracts to reduce nitrite, nitric oxide and nitrous oxide to nitrogen. From crude extracts of cells grown on nitrate, nitrite or nitrous oxide, separate complex fractions were obtained that utilized NADH as the source of electrons for the reduction of (1) nitrite to nitric oxide, (2) nitric oxide to nitrous oxide, and (3) nitrous oxide to nitrogen. Gas chromatographic analyses revealed that each of these fractions reduced only one of the nitrogenous oxides. W71-09262

# THE STUDY OF THE PHYSICAL, CHEMICAL AND BIOLOGICAL NATURE OF WATER QUALITY UNDER UTAH CONDITIONS,

Utah State Univ., Logan.
For primary bibliographic entry see Field 05A.
W71-09268

EFFECTS OF CARBONATE AND MAGNESIUM ON CALCIUM PHOSPHATE PRECIPITATION, Stanford Univ., Calif. Dept. of Civil Engineering. John F. Ferquson, and Perry L. McCarty. Environmental Science and Technology, Vol 5, No 6, p 534-540, June 1971. 7 p, 9 fig, 2 tab, 23 ref.

Descriptors: \*Phosphates, \*Waste water treatment, \*Chemical precipitation, \*Anaerobic digestion, Nutrients, Water pollution control, Carbonates, Magnesium, Analytical techniques. Identifiers: \*Phosphate removal.

The effect of magnesium and carbonate on calcium phosphate precipitation was investigated at concentration conditions resembling those in the anaerobic digestion process and at concentration ratios typical of waste waters. The systems were allowed to precipitate at constant temperatures (20 to 30 deg C). The precipitation time was usually 24 hr, but varied from 1 min to several weeks. With magnesium present, the phosphate residual decreased gradually; low values were found at pH above 9. Without magnesium, local minimum and maximum in the residual phosphate were found, respectively, at pH 8 and 9.5. Calculated activity products and solids analyses supported a hypothesis of the effect of magnesium on the precipitated solids. Higher carbonate concentrations increased the phosphate residual at pH 8 to 11. The effects was reduced in systems with high magnesium concentrations. (Knapp-USGS)

## NEW PROCESS DETOXIFIES CYANIDE WASTES,

H. Martin Malin, Jr.

Environmental Science and Technology, Vol 5, No 6, p 496-497, June 1971. 2 p, 1 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Oxidation, Poisons, Chemical Neutralization.

Identifiers: \*Cyanides, \*Plating wastes.

The widespread use of cyanides--particularly sodium cyanide and hydrocyanic acid--and the extreme toxicity of the free cyanide ion, make adequate

detoxification of cyanide-laden effluents a matter of considerable environmental importance. The process most frequently used to decompose cyanides is alkaline chlorination, which may be accomplished in two ways. First, sodium hypochlorite may be added directly to the waste stream. Cyanide is then rapidly oxidized to cyanate. Cyanates can be completely converted to carbon dioxide and ammonia by acid hydrolysis. Lowering the pH of the effluent to 2 or 3 to destroy cyanates involves yet another neutralization of the acidic solution before the effluent can be discharged. Another detoxification procedure--electrolytic oxidation--is some-times applicable when cyanide concentrations are very high. A novel process which should appeal primarily to small plant operators oxidizes cyanide from plating wastes to cyanates and simultaneously precipitates zinc or cadmium complexes which can be removed by simple filtration. The key to the process is a proprietary peroxygen formulation. It contains 41% hydrogen peroxide with trace amounts of stabilizers and a small amount of a patented catalytic compound in aqueous solution. Operating costs can be as much as 25% below those for alkaline chlorination with hypochlorite. (Knapp-USGS) W71-09295

SHORE EVALUATION OF A PROPRIETARY 10-20 MAN WASTE TREATMENT SYSTEM DESIGNED FOR SHIPBOARD USE,

Coast Guard, Washington, D.C. Applied Technolo-

gy Div. Carl L. Schaller, and Thomas S. Scarano. Available from the National Technical Information Service as AD-718 467, \$3.00 in paper copy, \$0.95 in microfiche. Final report, Feb 1971. 19 p, 3 fig. Project No 714122/100.

Descriptors: \*Waste water treatment, \*Activated carbon, Filtration, Adsorption, Aeration, Anaerobic digestion, Biochemical oxygen demand, Coliforms, Aerobic treatment, Sewage treatment. Identifiers: Shipboard use, Bio-oxidation, Ultraviolet disinfection, Comminutor, Sanitary

A shore test program was conducted to determine the effectiveness of a proprietary 10-20 man treatment system designed for shipboard use. The system investigated made use of activated carbon for the purpose of filtration/adsorption and bio-oxidation of sanitary wastes. Influent and effluent waste properties were determined. Physical modifications were accomplished to convert the mode of operation from aerobic-anaerobic filtra-tion/digestion to aerobic filtration/digestion. Test results indicated that the system was incapable of treating raw sanitary wastes, primarily because of plugging of the carbon columns with undigested solid material. W71-09344

REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.

Tri-County Regional Planning Commission, Peoria,

Available from the National Technical Information Service as PB-196 835, \$3.00 in paper copy, \$0.95 in microfiche. Tri-county Regional Planning Commission Contract Report, Feb 1970. HUD-III-P-293.

Descriptors: \*Regional analysis, \*Water pollution treatment, \*Planning, \*Water distribution, Water supply, Drainage, Population, Storm drains, Waste

water, Sewage treatment, Solid wastes.
Identifiers: \*Regional planning, \*Illinois, Regional planning, Storm sewers, Refuse disposal, \*Solid waste disposal, \*Peoria County (III), \*Tazewell County (III), \*Woodford County (III).

The appraisal of the waste water, solid waste disposal, water supply, and storm drainage systems is for a three county Region in Central Illinois. Interim guidelines are set forth to guide the Commission in reviewing applications for federal assistance related to any of the four systems. An evaluation of the four systems indicate the present status of waste water and solid waste disposal systems are in need of top priority for planning commission actions. Nearly 80% of the region's 350,000 residents are served by systems which treat the waste water to a population equivalent of only approximately 80,000. Needs and Planning Commission actions are presented for the four systems. A study design is presented for future investigation needed to prepare comprehensive regional plans for these systems. W71-09356

CONCEPT DEVELOPMENT OF A HEAVY DUTY OIL CONTAINMENT SYSTEM FOR USE ON THE HIGH SEAS.

Atlantic Research Corp., Costa Mesa, Calif. Missile Systems Div.

Available from the National Technical Information Service as AD-719 615. \$3.00 in paper copy, \$0.95 in microfiche. Concept Development of a Heavy Duty Oil Containment System for use on the High Seas, Volume 1, Final Report, Jan 1971. 247 p, 18 tab, 100 fig, 18 ref. Contract No DOT-CG-00492-

Descriptors: \*Water pollution control, \*Oil wastes, \*Oily water, \*Cleaning, \*Barriers, Ships, Design, Model studies, Test procedures. Identifiers: \*Containment system, Oil booms.

Description and analysis of a model test program and design characteristics of a heavy duty oil containment system are presented. The design is intended for long deployment periods and is capable of air transportation to the area. Large Coast Guard vessels or Navy salvage ships are utilized for deployment. This barrier system guides the oil into a containment area using multi booms for collection and recovery. The barrier is Y shaped formed by 100 foot segments linked together. Each section has two main parts: an inflated cylinder that provides flotation and a water filled submerged skirt for dynamic and static stability. The oil containment phenomena and performance characteristics are discussed. (Ensign-PAI) W71-09367

SALINE WATER CONVERSION ACT OF 1971 (A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONTINUE RESEARCH AND DEVELOPMENT FOR THE TREATMENT OF SALINE AND OTHER CHEMICALLY CONTAMINATED WASTE WATER TO MAINTAIN OR IMPROVE THE QUALITY OF WATER).

For primary bibliographic entry see Field 06E. W71-09435

BILL TO REQUIRE THE SECRETARY OF THE ARMY, ACTING THROUGH THE CHIEF OF ENGINEERS, TO ENGAGE IN PUBLIC WORKS FOR THE PREVENTION AND CONTROL OF WATER POLLUTION.

For primary bibliographic entry see Field 06E. W71-09436

NUTRIENT REMOVAL AND ADVANCED WASTE TREATMENT.

Pittsburg Univ., Pa. Graduate School of Public Health.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970. 265

Descriptors: \*Eutrophication, \*Tertiary treatment, \*Water quality control, Ammonia, Nitrogen, Phosphorus, Algae, Feasibility studies, Technical feasibility, Economic feasibility, Pilot plants, Ion exchange, Electrolysis, Chemical precipitation,

Nitrification, Denitrification, \*Waste water treat-

The 8th Pittsburg Sanitary Engineering Conference was conducted in February of 1970 to assemble current techniques and methods of nitrogen and/or phosphorus removal. A few of the methods presented are: (1) cation exchange; (2) electrolysis; (3) breakpoint chlorination; (4) ammonia stripping; and (5) many others. Removal efficienstripping; and (5) many others. Removal efficiencies for ammonia, in particular were reported as high as 93%. Systems were tested and retested using various feed rates, system loadings, pH ranges, temperature, etc. Many of the techniques reported not only removal efficiencies but costs in terms of cents/1000 gallons of throughput. For example, column denitrification of water containing 20 mgl as NO3-N, and using a 3/1 ratio of methanol to nitrogen, was reported at 2.8 cents/1000 gallons for chemicals. By gathering together all of this information and discussing and reproducing it, it was hoped that future lake, river, and stream eutrophication could be prevented by taking preventive action before the waters are destroyed or irreparably damaged. (See also W71-09451 thru W71-09464) (Lowry-Texas) W71-09450

PHOSPHORUS REMOVAL BY CHEMICAL AD-DITION DURING PRIMARY TREATMENT,
Robert A. Taft Water Research Center, Cincinnati,

Ohio. Advanced Waste Treatment Research Lab. Richard C. Brenner.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 29-36.17 fig.

Descriptors: \*Phosphorus, \*Chemical precipitation, \*Biological treatment, Iron, Aluminum, Lime, Chemicals, Effluent, Trickling filter, Activated sludge, \*Waste water treatment. Identifiers: Polymers.

The current approaches for removing major fractions of phosphorus from waste water are: maximization of biological removal, straight chemical precipitation, and combined chemical-biological interaction using mineral additions. The chemicals used for phosphorus removal in the primary tank are: iron salts plus base plus or minus polymer, aluminum salts and polymer and lime. In the secondary system, iron salts and aluminum and activated aluminia columns are used. The choice of chemicals depends on many factors such as, influent phosphorus level, effluent discharge standard, plant size, etc. The advantages of phosphorus removal in the primary systems are listed. Experimental results employing iron precipitation in the primary sedimentation basin in primary plants, trickling filters and activated sludge plants are all listed and illustrated in various figures. (See also W71-09450) (Rayyan-Texas) W71-09451

ADVANCED WASTE TREATMENT

ADVANCED WASTE TREATMENT AT WASHINGTON, D.C.,
Robert A. Taft Water Research Center, Cincinnati,
Ohio. Advanced Waste Treatment Research Lab.
Thomas P. O'Farrell, Dolloff F. Bishop, and Stephen M. Bennett.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 99-129. 5 fig, 7 tab, 4 ref.

Descriptors: \*Waste water treatment, \*Filtration, \*Stabilization, Adsorption, Chlorination, Sludge, Lime, Flow diagram, Precipitation, Weirs, Flocculation, Turbidity, \*District of Columbia.

The advanced treatment pilot plant consists of chemical clarification, filtration, water stabilization, carbon adsorption, chlorination, sludge disposal, and a chemical recovery system. Description of all the above units along with a flow diagram is presented. The complete advanced treatment with two-stage lime precipitation and ferric addition to the second clarifier removed 95%

## Group 5D—Waste Treatment Processes

phosphorus and 95% TOC from a minimum quality DC. secondary effluent. The average residual of phosphorus was 0.4 mg/l, 2.3 mg/l, TOS and .4 units turbidity. The replacement of the ferric floculant reduced the average total removals to 94% phosphorus and 92% TOC with a turbidity of 1.6 units. In all two-stage operations the slurry pool in the first clarifier was unstable, with subsequent expansions causing periodic overflow of the weirs. These overflows were captured in the second clarifier. The single stage (pH 11.5) removed 96% phosphorus and 86% TOC, while lime alone removed 92% phosphorus and 51% TOC. The effiremoved 92% phosphotus and 37% force in efficiency of the filtration system depended on the efficiency of the clarification system. The dual media filter runs averaged 59 hours and the sand filter runs averaged 32 hours. Adsorption removed 75% of TOC in low turbidity. The carbon loading factor averaged 0.133 lb TOC/lb carbon for 12 x 40 mesh carbon. (See also W71-09450) (Rayyan-Texas) W71-09452

## PHOSPHORUS REMOVAL BY ALUM AND

IRON CLARIFICATION, Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. Carl A. Brunner.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p

Descriptors: \*Phosphorus, \*Aluminum, \*Iron, Hydrogen ion concentration, Economics, Pilot, Flocculation, Activated sludge, \*Waste water treatment.

Identifiers: Clarification, Calcination.

Orthophosphate is effectively removed by alum and iron salts. 80% phosphorus removal was achieved using an iron to phosphorus ratio of 1:1, while 80% removal with alum required an alum to phosphorus ratio of 1.2 to 1. The most effective pH is 6 for Al and 4 or less for ferric ion. Polyphosphates are also removed, but less effectively, by iron and aluminum. Conventional upflow or longitudial clarification equipment can be used for phosphorus removal using alum or iron salts. Phosphorus removal with iron or alum is technically possible but not economical. However, this method could be used economically at small plants or as a phosphate polishing process. (See also W71-09450) (Rayyan-Texas) W71-09453

## **ALTERNATIVE METHODS FOR PHOSPHORUS** REMOVAL, Robert A. Taft Water Research Center, Cincinnati,

Ohio. Advanced Waste Treatment Research Lab. Carl A. Brunner.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Nutrient Removal and Advanced Waste Treatment, Feb 1970, p 131-134.

Descriptors: \*Phosphorus, Nutrients, Tertiary treatment, Nitrogen, \*Chemical precipitation, \*Absorption, \*Anion exchange, Sedimentation, Separation techniques, Ion exchange, Semi-permeable membranes, Resins, Hydrolysis, Solubility, Cost analysis, Technical feasibility, Economic feasibility, \*Waste water treatment. Identifiers: \*Regeneration.

The three major phosphorus removal mechanisms discussed are: (1) sorption on activated alumina; (2) precipitation with Lanthanum salts; and (3) anion exchange. Absorption has been more extensively investigated. Phosphorus is the only nutrient removed, and a preliminary cost estimate is 5-6 removed, and a pleasantary coar estimate is occurs/1000 gallons, based upon regeneration of the alumina, and lime precipitation of the eluted phosphate and other impurities allowing re-use of the NaOH regenerant. Lanthanum precipitates only orthophosphates, and using a La:P ratio of 1:1, residual P concentrations of .01 mg/l can be obtained at pH between 5 and 9.0. Sufficient Lanthanum hydrolysis takes place to prevent any

Lanthanum from being lost in the effluent. A recovery method for recovering the expensive Lanthanum must be developed, if such a recovery scheme exists, before the process becomes economically feasible. Anion exchange columns have the capability to remove both phosphorus and nitrogen. Presence of other anions in domestic waste water was shown to have no effect on the rate at which nitrogen and phosphorus ion were exchanged. However, lime precipitation of the regenerant would remove only the phosphates causing a nitrogen buildup, necessitating disposal of some of the brine, and resultant disposal problems. Preliminary cost estimates have set costs for anion exchange at 10 cents/1000 gallons for a 10MGD plant. Pilot scale studies are continuing to provide more accurate information. (See also W71-09450) (Lowry-Texas)

## RE-USE AND DISPOSAL OF ALUM AND LIME

SLUDGES, Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. Robert B. Dean.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 135-145. 4 fig, 13 ref.

Descriptors: \*Sludge disposal, Water chemistry, Water softening, Hardness (Water), Chemical precipitation, Phosphates, \*Lime, Dewatering, Freeze drying, Solubility, Filtration, Pressure, Temperature, Incineration, Digestion, Cost analysis, Technical feasibility, Economic feasibility, \*Waste water treatment, \*Water reuse.

Identifiers: \*Chemical recovery, \*Alum, Re-carbonation.

Both lime and alum precipitation reactions produce sludge which must be handled in some manner. First of all, the choice must be made as to whether the sludge is to be disposed of or treated for re-use of the chemicals in it. 250 mg/l of lime produces 500-600 mg/l of sludge with and underflow concentration of 2-3% or 2 tons of sludge solids per mgd. This sludge may be used for soil stabilization, fill for roads, or in agriculture. However, by heating the precipitated calcium carbonate, calcium oxide can be recovered and re-used. The cost of lime recovery is the same as the cost of new lime, but disposal costs are significantly reduced. Costs reported from Dayton, Ohio are \$10-\$12 per ton, while the Lake Tahoe plant reports lime recovery as costing \$20/ton. The results of testing 4 laboratory scale, 75 liter treatment systems are reported and compared with regard to phosphate removal, sluge dewaterability, sludge filterability, and sludge composition. Alum sludges contain 2 Al:1P and composition. Atthir studges contain 2 Attri and probably some Ca plus some organic matter. The sludge will settle to 10% solids, and is amendable to concentration by freezing. The sludge is not biodegradable, and can sometimes cause clogging of the soil when disposed on the land. Lime treated alum sludge can be filter pressed to remove in excess of 50% as soluble aluminate, however, incineration of alum sludge leaves little or no residue for disposal, so for alum, disposal may be less expensive than re-use. (See also W71-09450) (Low-. ry-Texas) W71-09455

DISPOSAL AND RE-USE OF LIME SLUDGE. Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. Dolloff F. Bishop, and Stephen M. Bennett. Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 147-179. 14 fig, 4 tab, 8 ref.

Descriptors: \*Chemical precipitation, \*Turbidity, \*Phosphorus, Sludge, Lime, Calcium carbonate, Slaking, Temperature, Hydrogen ion concentration, Pressure, Permeability, Filtration, Vacuum drying, Incineration, Design criteria, District of Columbia, Waste water disposal, Water reuse, \*Waste water treatment. \*Waste water treatment. Identifiers: \*Thickening, \*Recalcination.

Recalcination and re-use of lime allows the buildup Recalcination and re-use of lime allows the buildup of inert materials which generally improve the thickening and dewatering yield of the sludge, but decrease the Available Lime Index (ALI) and the slaking temperature. Data to indicate whether or not a minimum solids wasting rate for satisfactory slaking occurs is not available. Recovery and re-use slaking occurs is not available. Recovery and re-use has always included some wastage to prevent high levels of inerts from building up. For lime processes at pH 11.5, solids loading and composition may be estimated from precipitation reactions, waste water component analyses, and the solids wasting rates. At the lower pH range of 9-10, this information must be obtained from jar tests. Lime sludge characteristics are dependent upon: (1) calcium carbonate content; (2) amount and type of non-carbonate solids removed; and (3) amount of recycled inert solids. Slight sludge characteristics. carbonate solids removed; and (3) amount of recycled inert solids. Slight sludge characteristics changes produce wide variability in thickening and dewatering yields. Thickening of modified secondary lime sludge from the FWPCA-DC pilot plant with a 75% CaCO3 content produced thickened with a 75% CaCO3 content produced thickened sludge of 20% solids by weight, and filter yields of 15 lbs dry solids/ft2/hr. By contrast, primary lime sludges thickened to only 10% solids and produced filter yields of 2lbs dry solids/ft2/hr. Therefore, onsite laboratory thickening tests and filter leaf tests on typical sludge are essential to the formulation of a rational design. (See also W71-09450) (Lowry-Tayan) Texas) W71-09456

#### NITRIFICATION AND BIOLOGICAL

DENITRIFICATION,
Robert A. Taft Water Research Center, Cincinnati,
Ohio. Advanced Waste Treatment Research Lab. Edwin F. Barth.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 181-193. 7 fig, 3 tab.

Descriptors: Nutrients, \*Nitrogen, \*Phosphorus, Nitrification, Denitrification, Ammonia, Chlorination, Disinfection, Biochemical oxygen demand, Nitrogen compounds, Alcohols, Carbon dioxide, Efficiencies, Corrosion, Aluminum, Sludge, Public health, Waste water treatment. Identifiers: \*Suspended solids.

Nitrogen in waste waters has been associated mainly with algal blooms. However, the BOD of most secondary effluents is due mainly to ammonia, oxidized nitrogen is a serious consideration in groundwater recharge situations, and both ammonia and oxides of nitrogen interfere with chlorine disinfection of water. Therefore, growing emphasis is being placed on removal mechanisms for nitrogen. However, chemical precipitation and biodegradation, two major methods for phosphorus and suspended solids and organic removal respec-tively, have been demonstrated to have little or no effect on nitrogen compounds. Therefore pilot plant studies have been initiated at Manassas, ginia, Archbold, Ohio, and at Notre Dame University, South Bend, Indiana. These pilot plants have consisted of multi-stage treatment for biological nitrification and denitrification, with some of the studies providing concurrent removal of phosphorus also. The highest % removal efficiency of nitrogen compounds reported here is 61%, which was achieved at the Archbold, Ohio installation. No cost estimates were tabulated since cost data has so far been relatively insufficient. (See also W71-09450) (Lowry-Texas) W71-09457

#### DENITRIFICATION OF SOLID MEDIA.

Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. Richard C. Brenner.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 195-221. 19 fig.

Descriptors: \*Denitrification, \*Nitrate, \*Activated carbon, Adsorption, Efficiencies, Temperature, Pressure, Dissolved oxygen, Head loss, Filtration, Turbidity, Chemical oxygen demand, Color, Odor, Nutrients, \*Waste water treatment. Identifiers: \*Methanol, Backwashing, Climatic conditions.

The accidental discovery that 50% nitrification could be achieved without chemical inducement in carbon columns stimulated investigations in this area. Since then pilot plants have been constructed at Firebaugh, California, Pomona, California, Lebanon, Ohio, and other locations. Both packed bed downflow and upflow columns have been tested. Results indicated that although upflow columns need very little backwashing, they also must be operated at surface loading rates of around 4 gpm/ft2 and have a contact time of one to two hours. Downflow columns, on the other hand, must be backwashed regularly, but are able to operate at 7 gpm/ft2 with a 10 minute or less contact time. Methanol was used as a substrate for all investiga tions reported, with optimum level of methanol established at 3 times the nitrate concentration. Varying media sizes seemed to have little effect on the process. Further work is needed to quantify the effect of varying temperature. Several modifica-tions of the denitrification process, including open tank denitrification, are included. For column denitrification of a water having influent NO3 of 20 mg/l and using an M/N ratio of 3/1, chemical costs averaged 2.1 cent/1000 gallons. For open tank denitrification of the same influent with M/N—4/1, chemical costs were reported to be 2.8 cent/1000 gallons. No cost estimates for equipment were available owing to the diversity of processes. (See also W71-09450) (Lowry-Texas) W71-09458

OTHER METHODS OF NITRATE REMOVAL, Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. R. B. Dean.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 223-227. 1 fig, 6 ref.

Descriptors: \*Denitrification, \*Nitrates, Ammonia, Nitrites, \*Ion exchange, Nutrients, Separation techniques, Nitrogen fixing bacteria, Tertiary treatment, Brines, Toxicity, \*Waste water treatment,

Identifiers: Nitrosomonas, Nitrobacter. Regenerant, Extended aeration.

The major forms of nitrogen in secondary effluents include: (1) ammonia-ammonium ions; (2) nitrite ions; and (3) nitrate ions. Ammonia is produced ions; and (3) nitrate ions. Ammonia is produced from urea and other organic nitrogen in sewage. There is an average of 14 mg/l of ammonia-ammonium ion in sewage and the recommended effuent limit is 1 mg/l as N. Nitrite ions are produced from ammonia and CO2 by nitrosomanas bacteria when organic food is low. Nitrite ions average 0.4 mg/l as N in secondary effuent and average 0.4 mg/l as N in secondary effluent, and their recommended limit is 1 mg/l as N. Nitrate ions are produced from nitrite and CO2 by ions are produced from nitrite and CO2 by nitrobacter, and this readily occurs in streams. Nitrate ions average 2.7 mg/1 in secondary effluent and their PHS limit is 10 mg/1 as N. Ammonia and nitrates are rarely both at high levels in one reactor. Ammonia is more prevalent in high rate systems, while nitrates are more commonly associated with extended aeration systems. Nitrate removal with ion exchange is technically feasible, but problems associated with disposal of regenerant brines have limited its application. Nitrates may also be limited its application. Nitrates may also be removed by chemical precipitation with ferrous salts, but again the procedure is limited to situations where ferrous salts are cheap and there is a convenient dump for the precipitates. Costs for nonspecific resins are 18 cent/1000 gallons plus brine disposal, 12 cent/1000 gallons for specific resins, and 4.5 to 8.5 cent/1000 gallons plus the cost of sludge disposal for chemical reduction. All costs are based on influent nitrogen of 20 to 10 mg/1 or less for a 10 mgd plant. (See also W71-09450) (Lowry-Texas)

#### AIR STRIPPING OF AMMONIA,

Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p

Descriptors: \*Ammonia, \*Nitrogen, \*Solubility, Cooling towers, Carbon dioxide, Lime, Hydrogen ion concentration, Temperature, Cost analysis, \*Waste water treatment. Identifiers: \*Air stripping.

Ammonia can be stripped from a solution by bubbling air through it only if the pH is first raised to 11.0 to convert the free ammonium ion to ammonium hydroxide. Ammonia, however, is over 1000 times more soluble in water than is CO2, necessitating a theoretical minimum of 220 ft3 of air for 90% ammonia removal from 1 gallon of water at 20C. Stripping towers become, in essence, water cooling towers, with subsequent cold weather operation difficulties. Also, the solubility of ammonia is increased with decreasing temperature, compounding the problem. Actual performance data from the Lake Tahoe plant indicate that under plant operation conditions, 300 ft3/gallon are acplant operation conditions, 300 its/gallon are actually required. In addition, calcium carbonate scale is formed by reaction with CO2 which must be removed. Reducing the ammonia content of a fluid from 20 mg/1 to 2 mg/1 would cost 2.3 cents/1000 at pH 11 and 9.9 cents/1000 gallons if the cost of the lime required to raise the pH to 11 is included. These costs are based on a 10 MGD. included. These costs are based on a 10 MGD plant, and they do not include scale removal. (See also W71-09450) (Lowry-Texas)

## REMOVAL OF AMMONIA BY SELECTIVE ION

Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. R. B. Dean.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 233-238. 2 fig, 5 ref.

Descriptors: \*Ammonia, \*Ion exchange, Zeolites, Selectivity, Resins, Nitrogen, Temperature, Hydrogen ion concentration, Lime, Adsorption, Calcium carbonate, Cooling towers, Brines, \*Waste water treatment. Identifiers: \*Regenerant, Stripping.

Zeolites have been developed which are selective for ammonia. At a given fraction of NH ..4 in solution, the fraction of NH .. 4 on the ion exchange material is much higher for the Hector clinoptilolite than for the conventional ion exchange resin, IR 120. Ammonium ion-specific zeolites are poor adsorbents for Caions, and therefore can be regenerated with limewater. Caions replace ammonium ions on the resin, and the high pH produces un-ionized NH3 from the NH ..4 ions. Sodium ions present in the solution act to speed up the regeneration. Limewater regenerant can be stripped of ammonia in packed columns or cooling towers, since volumes are 5% or less of the total flow, the water can be settled to remove calcium carbonate, replenished with lime, and re-used. There is no waste brine. Cost of ammonia removal by non-selective resins is estimated at 8.1 cent/1000 gallons, with the cost of brine disposal not included. Cost for selective zeolites are reported as between 3 and 6 cent/1000 gallons, with no brines to be disposed of, when treating 15-20 mg/l NH4-N. (See also W71-09450) (Lowry-Texas) W71-09461

## NITROGEN REMOVAL BY BREAKPOINT CHLORINATION, Robert A. Taft Water Research Center, Cincinnati,

Ohio. Advanced Waste Treatment Research Lab. Dolloff F. Bishop, and Thomas A. Pressley. Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania Feb 1970, p 239-247. 3 fig, 1 tab, 6 ref. Descriptors: \*Chlorination, \*Ammonia, \*Nitrogen, Oxidation, Nitrogen cycle, Hydrogen ion concentration, Hydrolysis, Neutralization, Alkalinity, Acids, Pilot plants, Cost analysis, Storage, Nitrates, \*Waste water treatment.

Identifiers: Breakpoint chlorination, Chloramines, Chlorine residual, Caustic.

Ammonia oxidation by 'breakpoint' chlorination provides a physical-chemical means for removing ammonia and completing the natural nitrogen cycle (i.e., oxidation of the ammonia to N2). Chlorine is added to the ammonia water until chlorine residual has reached a minimum and ammonia nitrogen has entirely disappeared. This method has been used for many years in the water industry and has been found to be pH dependent, with efficient breakpointing occurring only at pH 7-8.5. In natural water, non-ammonia chlorine demand may call for a chlorine to ammonia-nitrogen weight ratio of 15 to 1 or greater. Disadvantages of the method include: (1) satisfactory nitrogen removals may not be achieved if greater than 1 mg/1 of permanent residual nitrogen compounds occur such as NO3-; (2) large chlorine doses produce more acid by chlorine hydrolysis than can be neutralized by most waste waters, necessitating the addition of caustic to maintain a favorable pH range; (3) high chlorine demands require increased supplies of stored chlorine which represent a potentially hazardous condition; and (4) at chlorine costs of \$0.05/lb and a 200 mg/l dose, the cost for the chlorine alone is 8.3 cents/1000 galcost for the chlorine alone is 8.3 cents/1000 gallons. However, if pilot plant studies establish that acceptable removals can be obtained, on-site chlorine generation from bines, which produces both chlorine and caustic, may overcome the caustic and storage problems in large plants. The operation simplicity alone recommends the method for small plants. (See also W71-09450) (Lowry-Texas) W71-09462

#### OTHER METHODS OF AMMONIA REMOVAL, Robert A. Taft Water Research Center, Cincinnati,

Ohio. Advanced Waste Treatment Research Lab. Carl A. Brunner.

Proceedings, Pittsburg Sanitary Engineering Conference, 8, Pittsburg, Pennsylvania, Feb 1970, p 249-250.

Descriptors: \*Ammonia, \*Nitrogen, Feasibility studies, Economic feasibility, Technical feasibility, Ion transport, Resins, Electric currents, Anodes, Cathodes, Stainless steel, Lime, Hydrogen ion concentration, \*Waste water treatment.

Identifiers: \*Ligands, \*Complexes, Ammonia stripping, Regenerant, Platinum.

Three relatively new theoretical methods of ammonia removal are presented with reports on the various stages of developmental progress. Ligand exchange utilizes the fact that ammonia can form a cupro-ammonium complex, with 4 ammonium ions attaching to one copper ion. Attaching the ions to a resin bed would allow the ammonia water to be passed through and the ammonia to become complexed with the copper ions. With exhaustion of all complexing sites, the bed would have to be regenerated, and ammonia might possibly be recoverable from the concentrated regenerant. This method is only in the concept stage, with a laboratory feasibility study to start soon. Electrolytic oxidation of ammonia to elemental nitrogen involves the use of an electrolytic cell, platinum anodes, stainless steel cathodes, and cell voltages in the range of 0.5 volts. Current densities of less than 1 ma/om2 result in large electrode areas which, due to the high cost of platinum, make the method uneconomical. Research is continuing on a method of alloying platinum with other metals to reduce the cost. Finally, laboratory scale investigations of cation exchange membranes have produced as high as 93% removal of ammonia from synthetic waste water containing only sodium and ammonium cations. Alternate compartments in a stack would contain regenerant which would allow cations to replace the ammonia across the mem-

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5D—Waste Treatment Processes**

brane. Lime treatment and air stripping would remove gaseous ammonia and allow the regenerant to be re-used. (See also W71-09450) (Lowry-Texas) W71-09463

AMMONIA STRIPPING AT WASHINGTON D.C. Robert A. Taft Water Research Center, Cincinnati, Ohio, Advanced Waste Treatment Research Lab. Thomas P. O'Farrell, and Francis P. Frauson. Proceedings, Pittsburg Sanitary Engineering Conference, 8th, Pittsburg, Pennsylvania, Feb 1970, p 251-263. 5 fig, 2 tab, 1 ref.

Descriptors: \*Cooling towers, \*Ammonia, Temperature, Scaling, Calcium carbonate, Chemical precipitation, Lime, Aeration, Biochemical oxygen demand, Flocculation, Nitrification, Alkalinity, Hydrogen ion concentration, Phosphorus, Teratiry treatment, \*Waste water treatment, \*District of Columbia.

Identifiers: \*Ammonia stripping.

An ammonia stripping system, consisting of 5 towers, each packed with 40, 4 ft x 5 ft x 1/2 inch grids, was subjected to a 75 day test. The efficiencies of ammonia removal were determined at various air to liquid (G/L) rates. Liquid loadings were restricted to 1 gpm/ft squared due to the fan capacity. The data was combined to formulate an empirical curve which indicated that 500 ft cubed of air per liquid gallon is required for 90% ammonia removal. Temperatures averaged 78 and 77F for inlet air and water respectively, and pH ranged from 11.8 to 12.0. Accumulation of calcium carbonate in the system forced intermittent shutdown of the system for maintenance. Air to liquid rates decreased from an initial 350 ft cubed air/gallon of liquid to a final 250 ft cubed air/gallon of liquid, thus decreasing the efficiency of the system for ammonia removal, also on account of calcium carbonate buildup in the towers. A 20% system efficiency decrease toward the end was attributed to falling temperatures. Total scale accumulation in the towers was 2 tons, with each grid requiring manual cleaning. Removal of the CaCO3 also upset the chemical clarifier system. From these tests it was determined that scale deposition and reduced temperatures for part of the year preclude ammonia stripping as a feasible nitrogen removal mechanism in Washington, D.C. (See also W71-09450) (Lowry-Texas) W71-09464

#### 5E. Ultimate Disposal of Wastes

UTILIZATION AND STABILIZATION OF

SOLID WASTES, Bureau of Mines, Salt Lake City, Utah. Salt Lake City, Metallurgy Research Center. For primary bibliographic entry see Field 05D. W71-08962

AN ACT RELATING TO SANITARY SEWAGE DISPOSAL UNITS: OCEAN OUTFALL AND DISPOSAL WELL TREATMENT REQUIRE-

For primary bibliographic entry see Field 06E. W71-08999

ECONOMICS OF COMPOSTING MUNICIPAL REFUSE IN EUROPE AND ISRAEL, American Public Health Association, New York.

G. J. Kupchik.

Proceedings of the American Society of Civil Engineers Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol. 92, No. SA6, p. 41-56, December 1966, 4 tab.

Descriptors: \*Economics, \*Disposal, \*Costs, Operations, Survey, Amortization, Evaluation, Interest, Maintenance, Utilities, Income, Fertilizers, Atmospheric pollution, Soils, Refuse, Production. Identifiers: \*Composting municipal refuse, \*Pulverization, Salvage, Sale, Land rental, Reserve

This report came from a survey of various composting systems used in Europe and Israel, under different climatic, economic, and social conditions, by the author in 1965. The most common composting processes are Van Maanen process, Rasping system, Ventilated cell composting, Dano system, and Buhler system. Cost and income data collected from 14 composting plants included amortization, interest, reserve fund, land rental, personnel, utilities, maintenance and repairs, disposal of rejects, miscellaneous costs, salvage, and compost production and sales. Cost analyses was made to determine factors favoring successful operation. Tabulated data were costs of processing raw refuse, costs of processing raw refuse utilizing different composting systems, production and sale of compost, and comparison of costs for pulverizing and composting raw refuse. Applicability of composting refuse to the United States was discussed. Additional research and demonstration projects in refuse disposal methods are urgently needed. (Wang-Rutgers) W71-09417

A BILL TO REGULATE THE DISCHARGE OF WASTES IN TERRITORIAL AND INTERNA-TIONAL WATERS UNTIL FIVE YEARS AFTER THE ENACTMENT OF THE ACT AND TO PROHIBIT SUCH DISCHARGE THEREAFTER. For primary bibliographic entry see Field 06E. W71-09438

#### WASTE DISPOSAL IN DEEP WELLS.

National Industrial Pollution Control Council, Washington, D.C.

For sale by the Superintendent of Documents, US Government Printing Office, Washington DC 20402--Price \$0.25. National Industrial Pollution Control Council, Sub-Council Report (Feb 1971).

Descriptors: \*Waste disposal, \*Injection wells, \*Industrial wastes, \*Research and development, Geologic investigations, Legal aspects, Risks, Well regulations, Monitoring, Geological surveys, Standards, Classification, Geographical regions, Ultimate disposal, Waste identification, Damages.

The growing chemical complexity of waste products coupled with the severity of pollution standards has caused industry to view deep well disposal as possibly the only logical method for disposing of certain untreatable wastes. The National Industrial Pollution Control Council recommended immediate research by the federal government and industry to establish: (1) the geological factors involved in deep well disposal, (2) identification of all areas in the country amenable to this form of disposal, (3) a categorization of all wastes and their suitability for deep well disposal, (4) the legal status of deep well disposal, and (5) suitable procedures for monitoring deep wells and disposal areas. Using deep well waste disposal raises several legal questions. When does underground trespass start. To what degree and extent are the users liable for surface or subsurface damage to nearby properties. Who owns water-injected and groundwater recharge. The use of deep well disposal hasn't been sufficiently extensive to establish precedent as to legal responsibilities arising therefrom. Statutory regulations throughout the country are diverse, and ambiguity as to legal responsibilities deters widespread use of this method. (Gallagher-Florida) W71-09440

#### 5F. Water Treatment and **Ouality Alteration**

AUTOMATIC PLANNING OF THE LEAST-COST WATER DISTRIBUTION NETWORK,
Tahal Consulting Engineers, Ltd., Tel-Aviv
(Israel). Long Range Planning Sect.
For primary bibliographic entry see Field 06A.

#### 5G. Water Quality Control

TESTING AND EVALUATION OF OIL SPILL RECOVERY EQUIPMENT. Main Port Authority, Portland.

Copy available from GPO Sup Doc as SOD No EP 2.10:15080 DOZ 12/70, \$1.50; microfiche from NTIS as PB-200 081, \$0.95. EPA Report, Dec 1970. 162 p, 27 fig, 25 ref. FWQA Program no 15080 DOZ.

Descriptors: \*Oil, \*Separation techniques, Oilwater interfaces, Secondary recovery (Oil), Flotation, Evaporation, Currents, Turbulence, Test procedures, Measurements, Water pollution con-

trol, Water quality control. Identifiers: \*Oil spill recovery equipment, Curtain booms, Fence booms, Air barriers, Skimmers, Rate

The Gulf of Mexico, in March 1970, was the scene of a major equipment testing and evaluation study of oil spill control and recovery equipment. The tests took place during 30 knot winds, and 8 ft waves. The oil recovery equipment tested included mechanical barriers, air barriers, and skimming equipment. A detailed report containing both the test results on the capacilities and limitations of the various equipment types tested, and also recommendations on needed improvements was prepared. It was strongly recommended that adequate skimming capacity could be installed and maintained in close proximity to all major industries which would be considered potential oil spill hazards. Recommendations were also prepared concerning the methods of enlisting community aid, both in helping to support the installation of oil spill recovery equipment, and also in working to clean up such spills as do occur. Only through complete co-operation of population and industry can damages from oil spills be minimized, and both the technology and the guidance are now available to safeguard the marine environment and our recreational facilities from irreparable losses. (Lowry-Texas)

## EFFECTS OF CONTAMINANTS ON REAERATION RATES IN RIVER WATER,

Illinois State Water Survey, Peoria. V. Kothandaraman.

Journal Water Pollution Control Federation, Vol. 43, No 5, May 1971, p 806-817. 3 fig, 8 tab, 15 ref.

Descriptors: \*Aeration, \*Oxygenation, Rivers, Analytical techniques, Regression analysis, Sampling, Instrumentation, Dissolved oxygen, Saturation, Adsorption, Hydrogen ion concentration, Chemical oxygen demand, Biochemical oxygen demand, \*Water quality control, Wastes, Illinois, Waste water treatment.

Identifiers: \*Reaeration rate coefficient, Illinois

The reaeration rate constant has been shown to depend not only upon the presence or absence of various constituents in the water, but also upon the method used to calculate the constant. River water samples were taken, adjusted to pH 3.0 to suppress biological activity, and subjected to reaeration. Dissolved oxygen probes were used to measure dissolved oxygen concentrations. The Reed Theriault method afforded a unique value for K2 without

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requiring knowledge of dissolved oxygen saturation concentration. However, the gradient method is the best of all the available methods for evaluating the parameters of first-order reactions. The contaminants in the river water were discovered to alter the reaeration rate to the extent of plus or minus 15% as compared with distilled water. However, no specific relationship between the reaeration rate co-efficient and constitutent contaminants in river water was discovered which was applicable for all mixing conditions. (Lowry-Texas) W71-08944

## REVIEW OF THE FEDERAL WATER QUALITY ADMINISTRATION ESTUARINE STUDY FINDINGS,

Environmental Protection Agency, Boston, Mass.

Water Quality Office.
Lester M. Klashman, and John S. Farlow.
Journal Water Pollution Control Federal, Vol 43, No 5, May 1971, p 739-745.

Descriptors: \*Estuaries, \*Ecosystems, Water resources development, Recreation, Estuarine fisheries, Legislation, Water quality control, Administration, Water pollution control, Contract ad-

The Federal Water Pollution Control Administration established the Estuarine and Oceanographic Programs branch to carry out a study on pollution of the nation's estuaries. To facilitate this study, 30 public meetings were held in the various estuarine zones of the country and its possessions, and 22 contracts were negotiated to obtain specialized information. In addition, an automated information storage and retrieval system, the national estuarine inventory was developed. Some basic assumptions made by the national estuarine pollution study included the formation of an expanded, long range program to encompass the estuarine and coastal zones. Recommendations proposed by the study included suggested policies for local, state, and national governments, as well as for interested public and private interest groups. Support of all private interest groups and all regulatory agencies is needed in any protection plan to help alleviate the pollution already present and also to prevent further pollution, before the fragile ecosystems of our nation's estuaries and coastal areas degenerate beyond repair. (Lowry-Texas) W71-08945

#### TRANSPORT OF SHOAL DEPOSITS,

Illinois Inst. of Tech., Chicago. E. I. Shaheen, and W. Chantarasorn. Journal Water Pollution Control Federation, Vol 43, No 5, May 1971, p 872-882. 13 fig, 3 tab, 18

Descriptors: \*Shoals, \*Sediment transport, Sediments, Fluid friction, Suspension, Flow, Viscosity, Plasticity, Head loss, Turbulent flow, Laminar flow, Pipes, Pumps, Temperature, Water pollution con-

Identifiers: \*Pressure gradients, Friction factor.

Dumping of dredged solids into lakes has created many problems with respect to the aquatic environments present. An alternative to dumping these dredged solids back into bodies of water is land disposal. To avoid dumping in Lake Michigan, 2,000 acres will be needed at least. In highly urbanized areas, such acreages of land are not readily available, and some method of transporting the material to the dumping site is necessary Since a pipeline is possibly the most logical solution, the flow behavior of shoal deposits of up to 25.5 wt% was investigated in 0.5 and 1.0 inch pipelines. Pressure drops at various conditions were measured and used to formulate an empirical relationship for pressure drop as a function of several variables. Accuracy of this relationship was determined to be plus or minus 5%, and it was mainly recommended for suspensions in the turbulent flow region where the shear stress-shear rate relationship for laminar flow cannot be applied. A Brookfield viscometer

was used to determine flow parameters at solids concentrations of up to 27.1 wt%. Flow curves obtained were checked with experimental curves, and the curves showed Bingham plastic behaviour, with strong plasticity occurring with suspensions of greater than 10 wt% solids. (Lowry-Texas) W71-08947

## COMBINED SEWER REGULATION WITH

FLUIDIC REGULATION, Bowles Fluidics Corp., Silver Spring, Md.

Peter A. Freeman.

Journal Water Pollution Control Federation, Vol
43, No 5, May 1971, p 662-871. 12 fig, 3 ref.

Descriptors: \*Storm run-off, \*Sewers, \*Water pollution control, Flow control, Hydraulic structures, Orifices, Pipes, Headloss, Weirs. Identifiers: \*Fluidics, Static diversion strucutres, Combined sewers, Aspiration, Electromechanical,

Electrohydraulic.

Combined storm water overflow has become a significant pollutional load on stream, rivers, and lakes in many areas. One of the reasons noted for this was poor flow regulation devices in many areas. Nearly all the equipment which was simple to install and required little or no maintenance also provided less than adequate flow control. Applica-tion of the fluidic concept, however, seems to present several distinct advantages: (1) fluidics ele-ments offer the much improved flow regulation formerly possible only with float-operated units or the large electromechanical or electrohydraulic units; (2) fluidics units operate without mechanical moving parts; (3) fluidics elements can be easily adapted to structures in existing plants; and (4) fluidics installations offer the operational reliability and minimum maintenance and surveillance costs of static diversion structures. Fluidics elements, therefore combine the best features of most of the existing equipment types at a modest cost. (Lowry-W71-08948

#### TOWARDS BETTER ADMINISTRATION OF WATER QUALITY CONTROL,

Robert L. Haskins.

Oregon Law Review, Vol 49, No 4, p 373-393, 1970. 21 p, 147 ref.

Descriptors: \*Water quality control, \*Water pollution control, \*Water pollution treatment, \*Waste water (Pollution), Water quality, Impaired water quality, Standards, Water resources, Water purification, Rivers, Water treatment, Tertiary treatment, Sewage treatment, River basins, Running waters, Regulation, Legal aspects, Water policy, Water rights, Waste water disposal, Water pollution Water supply. tion, Water supply.

Administration of water quality control is the central subject of this note. Primary treatment, secondary treatment, tertiary treatment, and lagooning are discussed as methods of pollution control. The following administrative approaches to water quality control are examined: (1) stream standards, (2) effluent standards, (3) subsidies, and (4) effluent charges. Streams standards are not self executing and do not allocate a river's assimilative capacities except by haphazard enforcement. Effluent stan-dards enforcement is of such a complex nature that states have used uniform standards. This assures some abatement by all but fails to consider abatement cost differences or availability of alternative methods, thus causing greater than optimal cost results. The use of subsidies is a low incentive method of water control. The author feels that the biggest failure of the stream standards, effluent standards, and subsidies approaches has been their failure to deal with external diseconomies. The author concludes that the effluent charges approach provides the missing incentives and the most rational comprehensive method of allocating water quality control responsibility. (Robinson-Florida) W71-08979

RANSOMING THE MAINE ENVIRONMENT. G. Graham Waite.

Maine Law Review, Vol 23, No 1, p 103-118, 1971. 16 p, 69 ref.

Descriptors: \*Maine, \*Pollution abatement, \*Riparian rights, \*Public rights, Judicial decisions, Water pollution, Water pollution control, Eminent domain, Compensation, Land tenure, Administrative agencies, State jurisdiction, State governments, Local governments, Riparian land, Reasonable use, Competing uses, Municipal water, Navigable waters, Relative rights, Remedies, Waste disposal, Watershed management. Streams Political Watershed management, Streams, Political aspects, Legal aspects.

A study of court decisions in Maine indicates that the police power has been restricted to a narrow role in state programs for protecting natural resources, and thus has made a clean environment hostage to private property. Two specific decisions pose a serious threat to water pollution control through the police power. These decisions limited the jurisdiction of the Water and Air Environment tal Improvement Commission over new pollution to that coming from land within the watershed of the polluted watercourse. The cases have also applied a narrow and unnecessary test of navigability of the watercourse. These decisions rest on the conception that if government suspends the exercise of any individual riparian right, property has been taken and compensation must be paid. Some decisions dealing with expects concepts and eminant sions dealing with property concepts and eminent domain are also examined. Placing the bulk of en-vironmental rehabilitation costs initially on the taxpayer in the form of compensation awards dims the prospects for an effective state program for enrironmental improvement. (Smiljanich-Florida) W71-08981

# CONSTITUTIONAL DILEMMAS POSED BY STATE POLICIES AGAINST MARINE POLLUTION--THE MAINE EXAMPLE,

Daniel Wilkes.

Maine Law Review, Vol 23, No 1, p 143-174, 1971, 32 p, 110 ref.

Descriptors: \*Maine, \*Coasts, \*Pollution abatement, \*Public rights, Water pollution, Water pollution sources, Coastal marshes, Water pollution control, Industrial wastes, Water policy, Water resources development, Water quality control, Estuarine environment, State governments, State jurisdiction, Administrative agencies, Judicial decisions, Adjudication procedure, Interstate, Eminent domain, Compensation, Government finance, Legislation, Social aspects, Legal aspects.

The recently increased interest in ecological preservation has been thwarted in part by the fact that the laws of nuisance and various constitutional guarantees serve to protect the local landowner accused of marine pollution. The various constitutional attacks on coastal anti-pollution legislation are examined to determine possible bases for defending state pollution abatement actions. The unlawful taking attack focuses on the claim that denials of the right to use land to its highest commercial advantage amounts to a taking without compensation. State economics may preclude compensation for all such takings. Various statutes are examined and solutions are offered to resolve this problem for the benefit of the state. The burden of proof dilemma lies in the fact that, although past burdens have been borne by the person attacking a polluter, state courts now must shift those burdens or the state will lose its coastal environment. Various methods of accomplishing this shift are suggested. A further obstacle to the exercise of state power, the interstate commerce dilemma, is also examined with regard to out-of-state polluters. (Smiljanich-Florida) W71-08982

#### WATER POLLUTION CONTROL UNDER THE REFUSE ACT OF 1899.

Bill Leaphart.

Montana Law Review, Vol 32, No 1, p 120-129, 1971. 10 p, 61 ref.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Descriptors: \*Rivers and Harbors Act, \*Pollution abatement, \*Waste disposal, \*Navigable waters, Water pollution, Water pollution control, Remedies, Legislation, Administrative agencies, Administrative decisions, Navigation, Wastes, Navigable rivers, Flotsam, Waste dumps, Adoption of practices, Regulation, Waste water (Pollution), Environmental effects, Federal government, Legal aspects. Identifiers: \*Refuse Act of 1899.

An extensive study is made of the Federal Refuse Act of 1899 in order to ascertain its present viability as a method of water pollution abatement. Although the Act has seldom been enforced, it can be of considerable strategic value in pollution abatement. The dumping of refuse in navigable waters is prohibited, as is the depositing on the banks of navigable water of refuse which impedes navigation. Penalties for violations are provided, navigation. Penalties for Violations are provided, along with a provision encouraging informers, who may split the fine imposed. The definitions of 'refuse' and 'navigability' are examined to indicate the liberal definitions presently attaching to the terms. The policies of the Corps of Engineers and the Justice Department have, however, tended to emasculate the power of the Act. Under present regulations, the agencies will only prosecute where navigation has been impaired and where there has been willful violation. These restrictions are unnecessary for many provisions of the Act. Despite the refusal of these agencies to prosecute violators, a solution is suggested whereby informers may bring a common law cause of action, qui tam, which allows those who will share in a fine to bring an action enforcing the violation. (Smiljanich-Florida) W71-08983

PREVENTION, CONTROL, AND ABATEMENT OF AIR AND WATER POLLUTION AT FEDERAL FACILITIES,

For primary bibliographic entry see Field 06E. W71-08984

COLLECTION OF STEAM-ELECTRIC GENERATING PLANT POLLUTION CONTROL

For primary bibliographic entry see Field 06E. W71-08985

INDUSTRIAL POLLUTION CONTROL, For primary bibliographic entry see Field 06E.

LIABILITY FOR OIL POLLUTION CLEANUP AND THE WATER QUALITY IMPROVEMENT ACT OF 1970,

Douglas Meiklejohn.

Cornell Law Review, Vol 55, p 973-991, 1970, 19 p, 138 ref.

Descriptors: \*Water pollution, \*Oil, \*Water pollu-Descriptors: "water pollution, "Oil, "water pollu-tion control, \*Damages, Legislation, Water pollu-tion sources, Ships, Oil industry, Oil fields, Federal government, Pollution abatement, Legal aspects, Insurance, Cleaning, Oily water, Remedies.

Identifiers: \*Water Quality Improvement Act of

The Water Quality Improvement Act, a response to recent oil spills, is a major improvement over existing law, but its provisions should be extended. The Act's predecessors were inadequate, primarily because liability for pollution was limited to instances of gross negligence or willful discharge. Conversely, the Act prohibits oil discharges into United States waters, punishes violation by a civil penalty, requires reporting of violations, and authorizes the President to initiate clean-up. Although previous legislation limited pollution liability to the value of the vessel and its freight, the Act's limits are the lesser of \$100 per gross ton of the vessel or \$14 million. Unlike the Outer Continental Shelf Lands Act, the Water Quality Improvement Act applies to onshore and offshore

facilities and imposes liability for clean-up as well as penalties for violation. Nevertheless, the Act's liability limits are too low, and the liability of the owner may be insufficient to cover clean-up costs of even the Torrey Canyon spill, a small disaster compared to the potential pollution of a super-tanker. Although the owner-operator should be lia-ble for pollution as a risk of business, when pollution results from failure to enforce regulations government should be partly liable. Cargo owners' liability for oil pollution should also be considered. (Hart-Florida) W71-08988

THERMAL ELECTRIC POWER AND WATER POLLUTION: A SITING APPROACH,

Billy D. McDaniel. Indiana Law Journal, Vol 46, No 1, p 61-112, 1970. 52 p, 190 ref.

Descriptors: \*Thermal pollution, \*Thermal power-Descriptors: "Thermal pollution, "Thermal power-plants, "Ecology, "Legal aspects, Sites, Electric power industry, Hydroelectric plants, Legislation, Water quality, Water Quality Act, Administrative agencies, Federal government, State governments, Water quality control, Water pollution control, Pollution abatement, Fishkill, Water pollution sources, Water pollution effects, Washington.

Temperature is a critical factor in aquatic life; thus industries utilizing water as a coolant have a severe impact upon ecology. Abnormal temperature may kill a species of aquatic life outright, or destroy a link in its food chain, resulting in starvation. Destructive thermal pollution may be minimized by judicious site selection, construction, and operation of a thermal electric power plant. Those contesting siting, construction, or operation may sue on traditional water law grounds or on a nuisance theory. However, the burden of proof is an effective deterrent to relief. More effective relief might be attained through imposition of water quality standards established pursuant to the Federal Water Pollution Control Act and the Water Quality Act. Weaknesses in the Federal Water Pollution Control Act concerning thermal pollution have been remedied somewhat by passage of the 1970 Water Quality Improvement Act, which specifically regulates thermal discharge. Another statutory solution has emerged with passage in the state of Washington of a law regulating site selection for thermal-electric plants by creating a site selection evaluation agency. However, truly effective regula-tion of thermal discharge should only come with federal administrative reform and creation of a Federal Public Utilities Agency. (Hart-Florida) W71-08989

WHO'S RESPONSIBLE FOR POLLUTION. For primary bibliographic entry see Field 06É. W71-08990

THE PORTER-COLOGNE WATER QUALITY CONTROL ACT.
California State Water Resources Control Board.

Sacramento, Calif.

California State Water Resources Control Board, Sacramento, Calif (Nov 1970). 53 p, 1 map.

Descriptors: \*California, \*Water pollution control, \*Water quality control, \*Water resources developwater quality control, Water resources develop-ment, Grants, Water policy, Water pollution, Water quality, Water resources, State govern-ments, Legislation, Waste treatment, Waste disposal, Wastes, Financing, Capital supply, disposal, Wastes, Financia Capital, Pollution abatement.

California's Porter-Cologne Water Quality Control Act concerns the following areas: (1) policy of the Act, (2) definitions, (3) state water quality control, (4) regional water quality control, (5) enforcement and implementation, (6) state financial assistance, (7) water reclamation, (8) federal assistance, treatment facilities, (9) sewage treatment plant operator qualifications, (10) water wells and

cathodic protection wells, (11) discharges from houseboats on or in the waters of the state, (12) special water quality provisions, and (13) the Clean Water Bond Law of 1970. Published with the Act water Bond Law of 1970. Published with the Act are water code sections dealing with: (1) the State Water Resources Control Board, (2) water quantity and quality relationships, (3) adjudications to protect the quality of ground water, (4) water reclamation and ground water investigations by the Department of Water Resources, and (5) transportation and disposal of waste. (Robinson-Florida) W71.08991

CLEAN LAKES ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT).

For primary bibliographic entry see Field 06E. W71-08992

SERVICES ACT TO PROHIBIT THE DISCHARGE OF ELEMENTAL MERCURY AND ITS COMPOUNDS INTO ANY WATERS OF THE UNITED STATES WHICH DIRECTLY AFFECT THE PUBLIC HEALTH.

For primary bibliographic entry see Field 06E.

W71-08993 A BILL TO AMEND THE PUBLIC HEALTH

**EMERGENCY WATER POLLUTION PREVEN-**TION ACT OF 1971 (A BILL TO ESTABLISH AN IMMEDIATE PROGRAM FOR THE PREVENTION OF OCEAN POLLUTION).

For primary bibliographic entry see Field 06E.

OIL SPILL PREVENTION AND POLLUTION CONTROL.

For primary bibliographic entry see Field 06E.

HEINZ V BOROUGH OF ESSEX FELLS (CITY'S LIABILITY FOR DISCHARGING OIL INTO STREAM).

For primary bibliographic entry see Field 06E. W71-08996

VALUATION OF FLOW AUGMENTATION RELEASES.

Florida Univ., Gainesville. Dept. of Environmental Engineering.

Buford J. Carter, Jr., James P. Heaney, and Edwin E. Pyatt.

Journal of the Sanitary Engineering Division, ASCE, Vol 97, No SA 3, Proc Paper 8203, p 345-359, June 1971. 15 p, 5 fig, 1 tab, 10 ref, 2 append.

Descriptors: \*Flow augmentation, \*Waste water treatment, \*Water pollution sources, \*Water quality control, Rivers, Dams, Mathematical programming, Optimization.
Identifiers: Economic analysis, Regional planning.

A mathematical programming technique was used to derive an estimate of the value, measured in terms of waste water treatment costs avoided, of flow augmentation releases in a river with multiple waste sources. The overall methodology developed for quantifying flow augmentation benefits consisted of 2 main components: a simulation model and an optimization model. The purpose of the simulation model was twofold. First, it provided a technique for selecting the critical period (e.g., the one-in-10-yr 7-day low flow). Secondly, given the regional waste water treatment plant configuration specified by the separable convex programming model, it estimated the quantity of additional flow that would be needed in all other time periods of the planning horizon. The effect of additional flow in the activity coefficients in the optimization model was evaluated directly by examining limiting conditions on the quantity of available additional flow. Analyses were performed for a single source of augmented flow in the headwater reaches. The

#### Water Quality Control—Group 5G

effect of the quality of the augmented flow on its economic value was quantified. Included was a procedure for incorporating the dependence of the reaeration coefficients and travel time on the river discharge. (Veverka-Cornell) W71-09000

RADIOLOGICAL PHYSICS DIVISION. AN-NUAL REPORT, JULY 1968-JUNE 1969. Argonne National Lab., Ill.

Available from the National Technical Information Service as ANL-7615, \$3.00 in paper copy, \$0.95 in microfiche. Report ANL-7615, 1969. 233 p.

Descriptors: \*Water pollution effects, \*Fallout, \*Ecosystems, Great Lakes, Trace elements, Radium radioisotopes, Thorium radioisotopes, Uranium radioisotopes, Marine algae, Water pollution sources.

Identifiers: \*Cesium radioisotopes.

Includes 46 articles of which three concern radioisotopes in aquatic ecosystems: Concentrations of trace elements in Great Lakes fish; Concentration of radium, thorium, and uranium by tropical algae; and Behavior of fallout cesium-137 in aquatic and terrestrial systems. (Bopp-NSIC) W71-09013

COLUMBIA RIVER STUDIES. ANNUAL PROGRESS REPORT, 1968-1969, Washington Univ., Seattle. Lab. of Radiation

Ecology. A. H. Seymour.

Available from the National Technical Information Service as RLO-2047-5, \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2047-5, June 27, 1969.

\*Radioisotopes, \*Absorption, \*Columbia River, Phosphorus radioisotopes, Zinc radioisotopes, Instrumentation, Oysters, Standards, Radioactivity effects, Water pollution effects, Tritium, Water pollution sources.

Identifiers: Chromium radioisotopes, Yttrium radioisotopes.

Research is reported on: distribution of Hanfordproduced phosphorus-32 at North Head; effects of radionuclides on young oysters; Columbia River marine ecological effects; biological half life of zinc in oysters; thermal luminescent dosimeters; zinc-65 in the biota of the Washington coast; uptake of chromium-51 by a beach diatom; and preparation of new standards, spikes, and samples for gamma-ray spectrometry. (Bopp-NSIC) W71-09014

TAX CREDITS FOR EXPENDITURES ON POL-LUTION ABATEMENT FACILITIES.

For primary bibliographic entry see Field 06E. W71-09016

REGULATION OF DRILLING FOR AND DISPOSAL OF SALT WATER.

For primary bibliographic entry see Field 06E.

AN ACT TO PROHIBIT THE SURFACE DISCHARGING SALTWATER ON THE SURFACE OF LANDS; TO PROHIBIT TAX DEDUCTIONS TO THOSE WHO DISCHARGE SALTWATER: AND FOR OTHER PURPOSES. For primary bibliographic entry see Field 06E. W71-09040

FRANCHISE TAX DEDUCTIONS FOR COST OF ANTI-POLLUTION DEVICES, SYSTEMS AND FACILITIES.

For primary bibliographic entry see Field 06E. W71-09042

STATE SALES TAX EXEMPTION FOR PROCEEDS FROM THE SALE OF ANTI-POL-LUTION DEVICES, MATERIALS, SYSTEMS AND FACILITIES.

For primary bibliographic entry see Field 06E. W71-09064

PYRITE DEPRESSION BY REDUCTION OF SOLUTION OXIDATION POTENTIAL.
Utah Univ., Salt Lake City. Dept. of Mineral En-

gineering. For primary bibliographic entry see Field 05D. W71-09078

LIGHTNER V CITY OF RALEIGH (DAMAGES FROM SEWAGE EMPTIED INTO CREEK ADJACENT TO PRIVATE PROPERTY). For primary bibliographic entry see Field 06E. W71-09085

TOWN OF SMITHFIELD V CITY OF RALEIGH (CITY'S DISCHARGE OF RAW SEWAGE INTO ANOTHER CITY'S WATER SOURCE). For primary bibliographic entry see Field 06E.

A GUIDE TO AQUATIC SMARTWEEDS (POLYGONUM) OF THE UNITED STATES, Virginia Polytechnic Inst., and State Univ., Blacksburg. Dept. of Biology. Richard S. Mitchell.

Available from the National Technical Information Service as PB-200 260, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Polytechnic Institute, Water Resources Research Center Bulletin 41, 1971. 52 p, 10 fig, 1 tab, 65 ref. OWRR Project A-028-VA

Descriptors: \*Aquatic plants, \*Systematics, \*Aquatic weeds, Floating plants, Rooted aquatic plants, Plant morphology.
Identifiers: \*Smartweeds, \*Polygonum, Polygonum

The taxonomic key of identifiable aquatic smartweeds, Polygonum sp, is supplemented by a review of the merits and shortcomings of different members of the genus in water management. The second part of the bulletin reports the results of submergence trials conducted in temperature-programmed environmental chambers. The amphibious responses of Polygonum populations were appraised on the basis of mortality of shoots and leaves, and morphology and anatomy of plants. P amphibium, var stipulaceum, and P densiflorum showed the greatest amphibious response. A study of the plagiotrophy or prostrateness of P amphibi-um varieties indicated that this property is partially genetically controlled and partly a function of the light-inhibited negative geotropism. (Wilde-Wisconsin) W71-09151

KELLUM V VILLAGE OF GREENUP (UN-RECORDED EASEMENT TO DISCHARGE SEWAGE).

For primary bibliographic entry see Field 06E. W71-09155

UTILIZATION OF HERBIVOROUS FISH IN FISH MANAGEMENT AND MELIORATION OF WATER BASINS, (IN RUSSIAN).

Vestnik Akademii nauk SSSR No 11, p 26-30,

Descriptors: \*Water quality control, \*Algae control, \*Forage fish, Biocontrol, Remedies, Foods, Fish, Herbivores, Fish management. Identifiers: USSR.

An address by G B Nikolski is reviewed which was delivered at the meeting of the Presidium of the USSR Academy of Science. At this time, the catch

of ocean inhabiting fish is inadequate to meet human population demands and an artificial culture of herbivorous fish can provide an inexpensive source of proteins. In addition to increasing the source of proteins. In addition to increasing the food supply, such culture will help to eradicate the detrimental growths of algae in irrigation and drainage systems and reservoirs of hydro-electric stations. Herbivorous fish of desirable properties are absent in both Europe and central Asia, but waters of far-eastern Siberia harbor three herbivorous (common and mottled thickheads and white amur), attaining weights over 20 and even 30 kg. The two varieties are not competitors as they derive their sustenance from either near-bottom or surface phytoplankton. The presidium approved a surface phytoplankton. The presidium approved a broad program of investigation of herbivorous fish in Asia, Africa, and South America, and a systematic acclimatization of suitable stock in different parts of the USSR. (Wilde-Wisconsin) W71-09163

LOVE V NASHVILLE AGRICULTURAL AND NORMAL INSTITUTE (MEASURE OF DAMAGES FOR SPRING POLLUTION). For primary bibliographic entry see Field 06E. W71-09166

FIRST TRUST CO V PEPPER BROS (RECOVERY OF DAMAGES FOR DESTRUCTION OF ICE CROP BY OIL POLLUTION). For primary bibliographic entry see Field 06E. W71-09169

CITY OF HARRISONVILLE V W S DICKEY CLAY MFG CO (REMEDY FOR MUNICIPAL POLLUTION OF PRIVATE PROPERTY). For primary bibliographic entry see Field 06E.

FRANK TEA AND SPICE CO V L SCHREIBER AND SONS CO (PROPERTY DAMAGES FROM BLOCKAGE OF SEWER BUILT TO REPLACE NATURAL STREAM).

For primary bibliographic entry see Field 06E. W71-09175

PRIVATE REMEDIES FOR WATER POLLU-TION.

For primary bibliographic entry see Field 06E. W71-09195

FEDERAL AID TO STATES IN FISH AND WIL-DLIFE RESTORATION. For primary bibliographic entry see Field 06E.

WATER AND ENVIRONMENTAL QUALITY IMPROVEMENT ACT OF 1970.

For primary bibliographic entry see Field 06E. W71-09198

WATER QUALITY ACT OF 1965 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO ESTABLISH THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION.

For primary bibliographic entry see Field 06E. W71-09200

STATE CORPORATE INCOME TAX DEDUCTIONS FOR AMOUNTS INVESTED IN ANTI-POLLUTION DEVICES. SYSTEMS AND FACILITIES.

For primary bibliographic entry see Field 06E. W71-09202

AN ACT PROVIDING FOR TAXATION DEDUC-TION OF COST OF POLLUTION ABATEMENT DEVICES.

For primary bibliographic entry see Field 06E.

## Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5G—Water Quality Control

W71-09203

AN ACT PROVIDING FOR THE EXEMPTION OF STATE USE TAXATION OF POLLUTION ABATEMENT DEVICES OR FACILITIES. For primary bibliographic entry see Field 06E. W71-09204

**IMPROVEMENT** ENVIRONMENTAL **AUTHORITIES ACT OF 1969.** 

For primary bibliographic entry see Field 06E. W71-09205

CERTIFICATION OF WATER AND WASTE WATER TREATMENT PLANT OPERATIONS ACT.

For primary bibliographic entry see Field 06E. W71-09207

**GUIDELINES FOR AGENCY STATEMENTS ON** PROPOSED FEDERAL ACTIONS AFFECTING THE ENVIRONMENT.

Council on Environmental Quality, Wash, D.C. For primary bibliographic entry see Field 06E. W71-09208

ANIMAL SLAUGHTERING AND PROCESSING. For primary bibliographic entry see Field 06E. W71-09209

REGIONALLY CONSOLIDATED INDUSTRIAL WASTE WATER TREATMENT.

For primary bibliographic entry see Field 06E. W71-09210

RESOURCES MODELING QUASILINEARIZATION AND INVARIANT IM-BEDDING,

Kansas State Univ., Manhattan. Irving Keao Hwang.

M.S. Thesis, Department of Industrial Engineering, 1970. 153 p, 22 fig, 13 tab, 46 ref, 2 append. OWRR Project B-015-KAN (10).

Descriptors: \*Water quality control, \*Water pollution control, Dynamic programming, Least squares method, Optimization, Systems analysis.

Identifiers: \*Quasilinearization, \*Invariant imbedding.

Two techniques were used to obtain numerical solutions to water resources problems of the boundary-value type: quasilinearization and invariant imbedding. The quasilinearization technique imbedding. The quasilinearization technique (Newton-Raphson method), represented an iterative approach combined with linear approximations; while the invariant imbedding approach (invariant principle), reformulated the original boundary-value problem into a family of initial value problems by introducing new variables or parameters. Using quasilinearization it was shown that with very approximate initial guesses for the unknown parameters, only 3 to 7 iterations were needed to obtain a four or five digit accuracy. Its rapid convergence property was a powerful technique for dynamic modeling of stream quality problems. The invariant imbedding approach was useful in obtaining a sequential estimation scheme in which only current data were needed to estimate the current or future values of the parameters. A least squares criterion was used to obtain the optimal and also the state or the future concentrations of the pollutants were estimated by this effective approach. Has 46 references. (Veverka-Cornell) W71-09217

CITY OF FRANKFORT V SLIPHER (MU-NICIPAL SEWAGE DISPOSAL).

For primary bibliographic entry see Field 06E. W71-09218

DYNAMIC MODELING OF STREAM QUALITY BY INVARIANT IMBEDDING,

Kansas State Univ., Manhattan. Dept. of Industrial

Engineering.

E. Stanley Lee, and Irving K. Hwang.

Kansas Water Resources Research Institute, Contribution No 47. 16 p, 11 fig, 7 ref. OWRR Project B-015-KAN (6).

Descriptors: \*Dynamic programming, \*Water pollution, Digital computers, Forecasting, Least squares method, Estimating, Mathematical models. Identifiers: \*Invariant imbedding.

With a digital computer, the estimator equations obtained using invariant imbedding were used to estimate the parameters in river or stream pollution. By using these equations, the parameters were estimated directly from differential equations representing the pollution model and from measured noisy data such as BOD and DO. Another advantage of this approach was that a sequential esti-mation scheme was obtained. By using this sequential scheme, only current data were needed to estimate current or future values of the unknown parameters. A large amount of computer time and computer memory was saved. Not only the parameters but also the concentrations of pollutants were estimated. An effective forecasting technique was formed. The classical least squares criterion was used in the estimation. (Veverka-Cornell) W71-09220

MITCHELL REALTY CO V CITY OF WEST ALLIS (EXTENT OF DAMAGES CAUSED BY CITY'S POLLUTION OF STREAM). For primary bibliographic entry see Field 06E. W71-09231

WAGNER V TOWN OF CONOVER (CITY'S LIABILITY FOR DISCHARGE OF SEWAGE INTO STREAM).

For primary bibliographic entry see Field 06E.

CITY OF BARNESVILLE V PARHAM (CITY'S LIABILITY FOR DISCHARGING SÈWAGE INTO OPEN STREAM).

For primary bibliographic entry see Field 06E. W71-09244

SANITARY DIST OF CHICAGO V CHICAG PACKING CO (DISCHARGE OF STOCKYARD WASTE INTO SEWAGE CHANNEL). For primary bibliographic entry see Field 06E. W71-09245

WHERE DOES WATER QUALITY IMPROVE-

MENT BEGIN, Agricultural Research Service, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch.

For primary bibliographic entry see Field 05B. W71-09300

SUMNER V O'DELL (INJUNCTION TO PREVENT POLLUTION OF SPRING WATER BY CATTLE).

For primary bibliographic entry see Field 06E. W71-09333

WELLS V SHEETS (CITY'S LIABILITY FOR LANDOWNERS POLLUTING DITCH NOT PART OF THE CITY'S DRAINAGE SYSTEM). For primary bibliographic entry see Field 06E. W71-09371

BEAVER DAM COAL CO V DANIEL (POLLU-TION DAMAGE TO AGRICULTURAL LAND). For primary bibliographic entry see Field 06E. W71-09380

CONESTEE MILLS V CITY OF GREENVILLE (CITY'S LIABILITY TO LOWER RIPARIAN OWNER FOR SEWAGE DISCHARGE). For primary bibliographic entry see Field 06E. W71-09383

BUCKLES V CITY OF DECATUR (LIABILITY OF CITY FOR POLLUTION OF RIVER). For primary bibliographic entry see Field 06E.

CHRISTIE V SANITARY DISTRICT OF CHICAGO (LIABILITY FOR EXCESSIVE DISCHARGE OF WATER).

For primary bibliographic entry see Field 06E.

MANAGEMENT OF WATER QUALITY IN RELEASES FROM SOUTHWESTERN IM-POUNDMENTS,

O'Malley and Clay, Consulting Engineers, Houston, Tex.

Herman M. Clay, and E. Gus Fruh. Water Resources Bulletin, Vol 7, No 1, p 137-147, Feb 1971. 7 figures, 2 tables, 20 references.

Descriptors: \*Water quality control, \*Impound-ments, \*Reservoirs, Withdrawal, Municipal water, \*Stratification, Industrial water, Colorado River, Identifiers: \*Bohan - Grace Solution.

The objective here is to see whether selective withdrawal of water is possible in southwestern reservoirs. By use of the Bohan-Grace solution, prediction of outflow water quality was within 15 percent of reservoirs as shallow as 55 feet. Increases in rate of flow increased the withdrawal layer. (Campbell-Rutgers) W71-09401

NO-TILL CROPPING REDUCES POLLUTION. Dixon Springs Agriculture Center, Simpson, Ill. Dept. of Agronomy.

L. E. Gard. Compost Science, Vol. 12, No. 2, p. 3-5, March-April 1971.

Descriptors: \*Farm management, \*Crop production, \*Silts, \*Water pollution sources. Identifiers: Grantsburg silt loam.

The author describes the advantages of no-till cropping for grain crops as a possible solution to pollution problems. No-till cropping reduces soil runoff and the harmful pollutants found in the runoff. The author explains that since labor costs, and prices and marketing costs have increasingly brought larger acreages under one man's management, this type of cropping system provides benefits to the farmer in these areas as well. (Holmes-Rutgers) W71-09408

VICTORS ARE NOT JUDGED, San Diego State Coll. Calif. Dept. of Geography. Philip R. Pryde. Environment, Vol. 12, No. 9, p 30-39, Nov. 1970, 1

table, 2 figures, 14 references.

Descriptors: \*Water pollution sources, \*Water pollution control, \*Economics, \*Political aspects. Identifiers: \*U.S.S.R., Northern Donets River, Dnester River.

Water pollution is prevalent in the Soviet Union as in any other populous, industrial country. The author reviews the major pollution problems in the U.S.S.R. and briefly describes what has been done to correct the problems. He discusses the problems that the Soviet Union has encountered with enforcing water pollution regulations and how a system of fines has thus far been ineffective. The author ex-plains that little can be improved without the 'necessary monetary and enforcement measures.' (Holmes-Rutgers)

#### Techniques of Planning—Group 6A

W71-09416

HANDLING HOT WATER, WITH A PAYOFF,

New York State Dept. of Environmental Conservation, Albany; and State Univ. of New York, Albany; and State Univ. of New York, Albany. Atmospheric Sciences Research Center. S. P. (John) Mathur, and Ronald Stewart. The Conservationist, Vol 25, No 3, p 16-20, DecJan 1970-71. 13 ref.

Descriptors: \*Thermal water, \*Economic feasibility, \*Water reuse.

Identifiers: Catfish Farmers of America, Willamette Valley in Oregon.

This article describes various uses for hot water discharged by electric power plants. It is a summary of talks presented at a conference held September 16-18, 1970, sponsored by the New York State Department of Environmental Conservation. Cited in the article are examples of how agriculture and mariculture in Britain, Japan and Iceland have used the heated discharge directly. The article also discusses industrial and municipal uses of the thermal discharge through construction of integrated coupling of the power plant to a closed-cycle operation. (Holmes-Rutgers) W71-09423

#### MORE WATER TREATMENT NEEDED,

Environmental Health Service, Washington, D.C. C. C. Johnson.

Journal of Environmental Health, Vol 33, No 4, Jan-Feb 1971, p 332-337.

Descriptors: \*Water supply, \*Economies of scale, Public health, Municipal water, Vermont. Identifiers: Fall River.

The author describes the findings of the Bureau of Water Hygiene's Community Water Supply Study which revealed that 41 percent of the public water systems surveyed were supplying water of a quality below the standards set by the U.S. Public Health Service. In order to improve this situation the author suggests five steps which can be taken: better surveillance of water systems, mandatory chlorination, merger of small water systems into larger ones, assurance of sufficient trained manpower for water works operation, and increased conversion of individual wells into community water systems. (Holmes-Rutger) W71-09424

PHOSPHATES IN DETERGENTS AND THE EUTROPHICATION OF AMERICA'S WATERS. For primary bibliographic entry see Field 05C. W71-09429

PHOSPHATES IN DETERGENTS AND THE EUTROPHICATION OF AMERICA'S WATERS. For primary bibliographic entry see Field 05C.

**CONFERENCE REPORT ON HR 4148, WATER OUALITY IMPROVEMENT ACT OF 1970.** For primary bibliographic entry see Field 06E. W71-09431

FINANCIAL RESPONSIBILITY FOR OIL POL-LUTION CLEANUP.

Federal Maritime Commission, Washington, D.C. For primary bibliographic entry see Field 06E. W71-09432

AN ACT IN RELATION TO WATER SUPPLY, DRAINAGE, SEWAGE, POLLUTION, AND FLOOD CONTROL IN CERTAIN COUNTIES. For primary bibliographic entry see Field 06E.

WATER QUALITY STANDARDS (PROCEDURE

FOR REVISION). Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 06E. W71-09434

A BILL TO REQUIRE THE SECRETARY OF THE ARMY, ACTING THROUGH THE CHIEF OF ENGINEERS, TO ENGAGE IN PUBLIC WORKS FOR THE PREVENTION AND CON-TROL OF WATER POLLUTION. For primary bibliographic entry see Field 06E.

W71-09436

**CLEAN WATER COMMITMENT ACT OF 1971** (A BILL TO PROVIDE A NATIONAL COMMITMENT FOR FINANCING OF EXPANDED PRO-GRAMS UNDER THE FEDERAL WATER POL-COORDINATION IN DEVELOPMENT OF CLEAN WATER PROGRAMS).

For primary bibliographic entry see Field 06E.

A BILL TO REGULATE THE DISCHARGE OF WASTES IN TERRITORIAL AND INTERNA-TIONAL WATERS UNTIL FIVE YEARS AFTER THE ENACTMENT OF THE ACT AND TO PROHIBIT SUCH DISCHARGE THEREAFTER. For primary bibliographic entry see Field 06E. W71-09438

ACID MINE DRAINAGE (INDUSTRY ATTEMPTS TO DESCRIBE AND SOLVE POLLU-TION PROBLEMS).

For sale by Superintendent of Documents, US Government Printing Office, Washington DC 20402--Price \$0.20. National Industrial Pollution Control Council, Sub-Council Report (Feb 1971).

Descriptors: \*Coal mine wastes, \*Acid mine water, \*Water pollution treatment, \*Water purification, Mine wastes, Mine drainage, Acidic water, Acid streams, Pyrite, Iron bacteria, Waste water (Pollution), Water pollution sources, Water pollution effects, Pollutants, Chemical reactions, Lagoons, Acration, Sludge treatment, Reclamation (Waste water), Chemical properties, Acidity, Hardness (Water), Watershed management, Cost-benefit analysis.

Acid mine drainage includes all types of mine drainage associated with coal mining. This source of pollution of streams is now actively being attacked, primarily with simple chemical treatment processes. These leave behind troublesome problems of sludge disposal and hardened water. The principal sources of untreated acid mine drainage are abandoned deep mines and improperly reclaimed surface mines. This study recommends large capital outlays by private and public bodies to control and treat such discharges. These pollutants are formed when air and water combine with the mineral pyrite and unknown bacteria. Solutions are aimed at either preventing formation of or removing these pollutants by chemical treatment prior to release into streams. Mine sealing seeks to exclude air and water from the mine. As yet this has been unsuccessful. Drainage control seeks to minimize contact time between water and pyrite by removing the water through elaborate pumping procedures. Chemical treatment has been most effective. Both acidic and alkaline mine drainage water are aerated in large lagoons, but this creates a problem of sludge disposal and build-up of salts in equipment. Research in this area is directed by the Water Quality Office of the Environmental Protection Agency. (Rees-Florida) W71-09439 WASTE DISPOSAL IN DEEP WELLS.

National Industrial Pollution Control Council, Washington, D.C.

For primary bibliographic entry see Field 05E. W71-09440

NUISANCE LAW AS AN ENVIRONMENTAL

TOOL, For primary bibliographic entry see Field 06E. W71-09442

RIVERS, LAKES, AND STREAMS--REGU LA-

For primary bibliographic entry see Field 06E. W71-09443

TAXATION-POLLUTION CONTROL FACILI-TIES.

For primary bibliographic entry see Field 06E. W71-09444

AN ACT IN REALTION TO PREVENTION AND ABATEMENT OF AIR, LAND AND WATER POLLUTION.

For primary bibliographic entry see Field 06E. W71-09445

AN ACT TO CREATE SANITARY DISTRICTS IN CERTAIN LOCALITIES.

For primary bibliographic entry see Field 06E.

GIBSON V CITY OF TAMPA (DISCHARGE OF MUNICIPAL SEWAGE INTO COASTAL WATERS).

For primary bibliographic entry see Field 06E.

REUSS V MOSS-AMERICAN, INC (AUTHORITY FOR CITIZEN TO BRING QUI TAM ACTION FOR VIOLATION OF RIVERS AND HAR-BORS ACT).

For primary bibliographic entry see Field 06E. W71-09448

#### 06. WATER RESOURCES **PLANNING**

#### 6A. Techniques of Planning

**SIMULATION** OF WATER RESOURCE REGIMES, Maryland Univ., College Park. Dept. of Chemical

Engineering.
T. W. Cadman, and F. J. Munno.

Water Resources Research Center, University of Maryland, Apr 1971. 46 p, 9 ref, 4 append. OWRR Project A-001-MD (1).

Descriptors: \*Analog computers, \*Water resources, \*Simulation analysis, Reservoirs, Mathematical models, Water levels, Operations.

The objective of this project was to establish a working knowledge of the principles of analog simulation as they may be applied to water resources systems. Emphasis was directed to the use of the EAI TR-48 analog computer purchased for the region of the state o for the project. The principles of operation of the required analog components, the derivation of the mathematical description, the techniques of analog simulation to be employed, and the demonstration of the simulation on the TR-48 were presented by use of four examples, described in detail in the Appendices. The general features of the modern electronic analog computer were discussed in the first example. A simplified water reservoir system was considered in the next example and utilized many of these general features. In a third example, the

## Field 06—WATER RESOURCES PLANNING

## Group 6A—Techniques of Planning

difficult step of going from the physical situation to a mathematical model was illustrated first. Then the preliminary simulation procedures of developing a preliminary analog circuit, amplitude scaling the circuit and time scaling were presented. A trial and error problem was formulated. Finally the transient and spatial water level in the soil surrounding a reservoir was examined. The electronic analog computer proved to be a most useful tool in the simulation of water resources systems. (Kriss-W71-08974

ECONOMIC-ECOLOGIC ANALYSIS IN THE

ECONOMIC-ECOLOGIC ANALYSIS IN THE CHARLESTOWN METROPOLITAN REGION: AN INPUT OUTPUT STUDY, Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology. Eugene A. Laurent, and James C. Hite. WRRI Report No 19, Water Resources Research Institute, Clemson University, Clemson, South Carolina, Apr 1971. 102 p, 2 fig, 12 tab, 31 ref, 2 append. OWRR Project B-012-SC (3).

Descriptors: \*Input-Output analysis, \*Model studies, Economic impact, Ecology, resources, Cost analysis, South Carolina. Identifiers: Charlestown (SC).

model based on input-output analysis was developed to incorporate environmental as well as pecuniary values into management systems for natural resources. An environmental matrix showing the inflow from the environment and outflow to the environment associated with one dollar of gross sales by various economic activities was developed to fit within the system. The linking of the economic model to the environmental matrix completed the model. The linkage operation involved post-multiplying the environmental matrix by the inverse matrix of the input-output model to form an economic-ecologic matrix. The completed 31-sector economic input-output model was used to quantify economic-ecologic linkages in the Charlestown, South Carolina, study area. Resource environmental-income multipliers generated to indicate the direct and indirect impacts, both on the economic and ecologic systems of various types of economic growth as well as alternative management strategies. The model not only provided a planner with information on which sectors were likely to decrease the environmental quality of a region, but also which particular pollutants were likely to be responsible. (Veverka-Cornell) W71-09002

## A NEW TECHNIQUE FOR RELIABILITY CAL-CULATIONS, Stagg Systems, Inc., New York. W. R. Christiaanse.

Institution of Electrical and Electronic Engineers Translations Power Applications Systems, Vol PAS-89, No 8, p 1836-1847, Nov/Dec, 1970. 12 p, 15 fig, 1 tab, 12 ref, 5 disc.

Descriptors: \*Reliability, \*Mathematical analysis, Computer programs, Mathematical models, Interconnected systems, \*Transmission (Electrical), \*Analytical techniques, Matrix algebra, Electric power failure, Storms, Maintenance, Probability, Networks, Simulation, Calculations, Overloads, Performance.

Identifiers: Outages, Maintenance schedules.

A new technique for calculating the rate and duration of service interruptions in transmission and distribution systems is presented. The technique can be applied easily to large networks, networks with multiple sources, and networks of any configuration, not necessarily series-parallel subsystems. The approach is based on the traditional exponential probability density functions for time to failure and repair time, but incorporates a new mathematical concept. Results include the expected outage rate and outage duration for each bus, and a summary of the causes of outages at each bus. The

derivation of equations and the solution of a sample problem using a pilot computer program are included. In the present form, the technique does not include methods for representing dependent failures of nonparallel lines caused by overloads or tower failures. Provision is made for the effects of maintenance outages. The technique represents a useful planning tool in spite of the limitations.
(USBR) W71-09073

OPTIMIZATION OF DISCRETE OPERATIONS RESEARCH MODELS BY DIFFERENTIAL SENSITIVITY ANALYSIS,

Kansas State Univ., Manhattan. Dept. of Industrial

Engineering.
S. Waziruddin, and E. Stanley Lee.
Kansas Water Resources Research Institute, Contribution No 51, (undated). 18 p, 9 ref, 1 tab. OWRR Project B-015-KAN (9).

Descriptors: \*Operations research, \*Dynamic programming, Optimization, Mathematical models, Model studies, Management.

Multistage operations research problems when for-mulated for solution by the discrete principle usually resulted in a set of nonlinear differential equations of the boundary value type. Due to the nonlinearity of the system and also due to the com-plexity of operations research problems, standard methods for solving linear two-point boundary value problems in difference equations could not be applied easily. An algorithm based on dif-ferential sensitivity analysis was presented for solv-ing the above problem. The method was essentially based on an algorithm due to Padmanabhan and Bankoff (Chem Eng. Science, Vol 25, p 833, 1970) who proposed a method for overcoming the boundary value difficulty in continuous systems. The method was computationally simple and possessed good stability characteristics with a fast convergence rate. An added advantage was that the method in its present form did not handle easily state variable inequality constraints. Problems from the field of production and advertisement scheduling were solved for purposes of illustration. (Veverka-Cornell)

## OPTIMIZATION OF DYNAMIC OPERATIONS RESEARCH MODELS BY A FUNCTIONAL GRADIENT TECHNIQUE,

Kansas State Univ., Manhattan. Dept. of Industrial

Engineering. S. Waziruddin, and E. Stanley Lee.

Kansas State University Bulletin, Special Report No 93, Kansas Water Resources Research Institute, Contribution No 48, Jan 1971. 20 p, 11 fig, 1 tab, 9 ref. OWRR Project No B-015-KAN (7).

Descriptors: \*Dimensional analysis, \*Dynamic programming, Optimization, Mathematical models, Modd studies, Management.
Identifiers: \*Functional gradient technique,

Quasilinearization technique.

A functional gradient technique was used to solve production planning problems with end con-straints, inventory control, and advertising scheduleing problems and was shown to be effective for solving multi-dimensional dynamic optimization problems. A seven dimensional production problem was solved as an illustration of the effectiveness of this technique. As seen from the numerical examples, the functional gradient technique was capable of solving fairly large dimensional problems with or without end constraints. Due to the first order convergence properties, this technique is fairly stable even with initial approximations far removed from the true optimum. The main disadvantage of this technique was the slow rate of convergence near the optimum. It is recommended that the functional gradient technique be used to obtain a control trajectory close to the optimum; then switch to methods that have quadratic convergence properties such as quasilinearization or the second variational techniques to obtain the true optimum, thus assuring numerical stability and faster convergence rate. Advantages and disadvantages of the gradient techniques are discussed in detail. (Veverka-Cornell) W71-09216

RESOURCES MODELING WATER QUASILINEARIZATION AND INVARIANT IM-BEDDING,

Kansas State Univ., Manhattan. For primary bibliographic entry see Field 05G. W71-09217

IMBEDDING, **ITERATIVE** INVARIANT LINEARIZATION, AND MULTISTAGE COUNTERCURRENT PROCESSES III. ESTIMATION AND THE OVER-DETERMINED SYSTEM, Kansas State Univ., Manhattan. Dept. of Industrial

Engineering.
J. C. Noh, and E. S. Lee.

Presented at AIChE 67th National Meeting, Atlanta, Georgia, Feb 15-19, 1970. Typescript, undated. 34 p, 2 fig, 6 tab, 5 ref. OWRR Project B-015-KAN

Descriptors: \*Estimating, \*Least squares method,

Distillation, Dynamic programming.

Identifiers: \*Quasilinearization \*Invariant im-

The usefulness of the quasilinearization technique as applied to certain design problems where the reflux ratio is the unknown variable, was demonstrated. The problem was first formulated as a nonlinear two-point boundary value problem in difference equations. This boundary value problem was then solved by the quasilinearization technique. The main advantage of this technique was its quadratic convergence rate. Only 4 or 5 iterations were needed to obtain a 4 to 5 digit accuracy. As shown by numerical examples, convergence was obtained even if very approximate initial approximations or initially guessed values for the unknown functions were used. As an illustration, a simple binary distillation problem was first considered. Multicomponent distillation was then considered. It was shown that the multicomponent distillation problem could be formulated either as a boundary value problem or as an estimation problem depending on the number of terminal concentrations specified. This procedure completely eliminated a trial-and-error difficulty and treated over-determined systems in a straightforward manner by use of least squares criterion and minimization. (Veverka-Cornell) W71-09219

## DYNAMIC MODELING OF STREAM QUALITY BY INVARIANT IMBEDDING, Kansas State Univ., Manhattan. Dept. of Industrial

Engineering.
For primary bibliographic entry see Field 05G.

W71-09220

#### DYNAMIC PROGRAMMING, QUASILINEARIZATION AND THE DIMEN-SIONALITY DIFFICULTY,

Kansas State Univ., Manhattan. Dept. of Industrial Engineering. E. Stanley Lee

Journal of Mathematical Analysis and Applica-tions, Vol 27, No 2, p 303-322, Aug 1969. 20 p, 8 ref. OWRR Project No B-015-KAN (4).

Descriptors: \*Dynamic programming, \*Dimensional analysis, Computer programs, Mathematical

Identifiers: \*Quasilinearization technique.

With the linearization of nonlinear equations by the quasilinearization technique, a combined linearization and iteration scheme was obtained. By the use of this scheme, the dimensionality of the functional equation of dynamic programming was reduced to one in most cases. The advantage of this technique was that both the computer memory requirement and computation time were reduced considerably. The usefulness of this method depended heavily upon the rate of convergence of the quasilinearization technique, which was shown to be quadratically convergent in various numerical experiments if there was any convergence. Furthermor, convergence was obtained even with very approximate in-itial approximations for a large number of problems. The recursive functional equations of dynamic programming only needed to be solved 3 to 7 times, and the number of iterations required was generally independent of the number of the state variables. As was seen from the numerical examples, the scheme for overcoming the linearity ampies, the scheme for overcoming the linearity difficulty did not slow down the convergence rate appreciably. The main disadvantage of this approach was that the transformation or state variable equations must be differential. (Veverka-Cornell) W71-09221

#### ITERATIVE TECHNIQUES IN OPTIMIZATION, Kansas State Univ., Manhattan.

E. Stanley Lee. AlChE Journal, Vol 14, No 6, p 908-916, Nov 1968. 9 p, 2 fig, 18 ref. OWRR Project No B-015-

Descriptors: Dynamic programming, Optimization, Mathematical models. Identifiers: \*Quasilinearization.

The quasilinearization technique, which is essentially an iterative approximation scheme combined with linearization, was used to overcome the dimensionality difficulties of dynamic programming, especially for discrete systems which were ideally suited for obtaining dynamic pro-gramming solutions. The approach was based on the fact that if the difference of differential equations are linear, their closed forms of solutions can be obtained. This solution permitted the separation of effects due to the initial state from the effects due to the control variables. By using this separation combined with quasilinearization, the dimensionality of the functional equation of dynamic programming was reduced to one in most cases. First, the optimization problem in cross-current extraction with discontinuous objection functions was used to illustrate the technique. Then the technique was generalized to systems of difference and differential equations with fairly general objective functions. The main disadvantage of the present approach was that the transformation or state variable equations must be differential. Furthermore, in order to obtain the quadratic convergence property, the partial derivatives in the Taylor series expansion must be obtained accurately. (Veverka-Cornell) W71-09222

## AUTOMATIC PLANNING OF THE LEAST-COST WATER DISTRIBUTION NETWORK,

Tahal Consulting Engineers, Ltd., Tel-Aviv (Israel). Long Range Planning Sect. Elisha Kally.

Water and Water Engineering, Vol 75, No 902, p 148-152, Apr 1971. 5 p, 5 fig, 2 ref.

Descriptors: \*Economic efficiency, \*Water-distribution (Applied), Linear programming, Optimization, Costs, Planning, Hydraulics. Identifiers: Hardy Cross method.

With the advent of electronic computers, the planning of water distribution networks was radically changed by being made an automatic computer operation and by producing the most economic as well as the most effective solution to the planner's problem. To illustrate this planning method the use of an electronic computer was needed and was based on a combination of 2 techniques: (1) the computation of the hydraulic data of the network by the Hardy Cross method; and (2) finding the optimum solution for a water

supply network with the aid of Linear Programming. The results were the following: (1) The special computer program--the 'Network Optimiser'--produced cheaply and rapidly the best cost plan of both looped and tree-like networks; (2) In the case of a tree-like network, the Optimiser selected the optimal (i.e. the least cost) pipe alignment (out of a set of given possibilities) and also determined the optimal combination of diameters; (3) In a looped network, where the routes were fixed, and none of them was to be eliminated, the Optimiser indicated the best selection of pipeline diameters; and (4) When some or all of the network inflows were boosted by a pump, the optimal pumping head was also determined by the Optimiser, so that the whole set of pipeline diameters plus inflow heads was an optimal one. (Veverka-Cornell) W71-09223

#### COMPUTERISED OPERATION OF DISTRIBU-TION SYSTEMS.

City Water Board, San Antonio, Tex. Robert P. Van Dyke.

British Water Supply, No 1, p 15-23, Jan 1971. 9 p,

Descriptors: \*Distribution systems, Computer programs, Data collections, Control systems, Texas, Water supply. Identifiers: \*San Antonio (Tex).

General applications of supervisory control and computerized operation as well as those of the specific water system used by the City Water Board in San Antonio, Texas were discussed. To expand the water works system to meet the population explosion in San Antonio a computer system was established to enable the City Water Board to have a precise method of data acquisition and control, and to provide the operator of the control center with extremely accurate, dependable, and continuously updated information. The system was capable of expansion to handle a water distribution workload double the size of the one at the present time and additionally provide information and control for 3 more control heating and cooling plants. This system was designed for the most efficient and economical operation of the 2 plants, both for the present and for the years to come. (Veverka-Cor-W71-09224

#### LINEAR PROGRAMING MODELS FOR ESTI-MATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,

New Mexico Univ., Albuquerque

Water Resources Research, Vol. 6, No. 4, p. 1025-1032, Aug. 1970, 4 tables, 1 figure, 13 references.

Descriptors: \*Water allocation (Policy), \*Water demand, \*Crop production, \*Linear programming. Identifiers: \*Pecos River Basin, Miller's theorem.

This paper provides the results of applying parametric linear programing methods to estimate the agricultural demand function for imported water in the Pecos Basin. A parametric linear programing model suitable for the Pecos Basin is developed. Agricultural activities in which land is irrigated either by local or imported water and either ditch or sprinkler irrigation are developed and adjusted for forecasted 1980 prices. These agricultural activities are used by the parametric linear programing model, and various agricultural demand functions are obtained for the Pecos Basin. These functions show the expected quantities of imported irrigation water that would be demanded at different prices and under a variety of constraints. (Author's abstract) W71-09421

#### 6B. Evaluation Process

# ESTIMATION DEVIATIONS: THEIR EFFECT UPON THE BENEFIT-COST RATIO, Oklahoma Univ., Norman; and Iowa State Univ.,

Ames. R. P. Lutz, and H. A. Cowles.

Engineering Economics, Vol 16, No 1, p 21-42, Oct-Nov 1970. 22 p, 4 fig, 1 tab, 7 ref, append.

Descriptors: \*Benefit-cost analysis, \*Benefit-cost ratios, Contingency costs, Cost analysis, Estimated benefits, Estimated costs, Construction costs, \*Economic feasibility, \*Errors, Investment, Analysis, Irrigation systems, Indexes (Ratios), Mathematical models, Frequency distribution, Probability Desiries entires entires ty, Decision making.
Identifiers: \*Bureau of Reclamation, Density ratio.

Government expenditures have been expanding at a rapid rate in the U S, with no indication that this trend will be curtailed. The very nature of projects developed by these expenditures lends uncertainty to the estimates of costs and benefits that make up the benefit-cost ratio used for project justification. A technique for recognizing uncertainty and bias in estimates of benefits and costs and for compensating for their effects on the benefit-cost ratio is presented. Using the technique to analyze 48 proects of the Bureau of Reclamation, the authors found that for all projects, deviations of the realized benefit-cost ratios from those estimated indicated 44.2% less return to the nation's economy than was anticipated. With variation of this magnitude, the decision-maker should be provided information about the likelihood and extent of deviations from cost and benefit estimates to adequately ration capital among competing demands. (USBR) W71-09059

# WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN PENNSYLVANIA.

Corps of Engineers, Philadelphia, Pa. North Atlan-

For primary bibliographic entry see Field 04A W71-09112

# WATER RESOURCES DEVELOPMENT BY THE U. S. ARMY CORPS OF ENGINEERS IN THE DISTRICT OF COLUMBIA.

Corps of Engineers, Baltimore, Md. North Atlantic Division.

For primary bibliographic entry see Field 04A.

LAND RECLAMATION AND COMPLEX USE OF WATER RESOURCES (RUSSIAN: MELIORATSIYA ZEMEL' I KOMPLEKSNOYE ISPOL' ZOVANIYE VODNYKH RESURSOV), For primary bibliographic entry see Field 04A W71-09134

## FUTURE PROSPECTS OF ALGAE AND MAN, Vermont Univ., Burlington. Dept. of Botany. For primary bibliographic entry see Field 05C. W71-09157

AN ACT FOR A COMPREHENSIVE WATER AND RELATED LAND RESOURCES MANAGEMENT PROGRAM (THE ARKANSAS WATER

For primary bibliographic entry see Field 06E. W71-09201

## IDENTIFICATION AND INTERRELATION-SHIPS OF SECONDARY BENEFITS IN WATER-WAYS DEVELOPMENT,

Auburn Univ., Ala. Water Resources Research

Rex K. Rainer, and Charles R. White.

## Field 06—WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

Available from the National Technical Information Service as PB-200 653, \$3.00 in paper copy, \$0.95 in microfiche. Auburn University Water Resources Research Institute Bulletin 711, Apr 1971, 101 p, 2 fig, 3 tab, 701 ref (76 annotated). OWRR Project A-015-ALA (1).

Descriptors: \*Cost-benefit analysis, \*Water resources development, \*Inland waterways, \*Bibliographies, \*Abstracts, Reviews, Projects, Economics, Feasibility studies, Planning, Project planning, Management, Systems analysis, Social assects.

Identifiers: \*Secondary benefit analysis.

The evaluation of waterways development projects, and ultimately the selection of a project for action, is usually based upon anticipated benefits that accrue as a result of the development. The identification and assignment of dollar values to secondary benefits is, at best, extremely difficult and vague The interrelationships among both primary and secondary benefits are not well known. Available data on secondary benefits are scarce as are mathematical models that permit examination of the effect of such benefits on the project selection decision. This report includes a review of current and recently completed research in the area of secondary benefits related to waterways development, evaluation of the results of related and appropriate research, identification of promising areas of research, and an annotated bibliography of appropriate reference sources. The most critical is to develop data systems for watersheds. After an organized data base is available, studies of the rela-tionships of all pertinent factors within a watershed should be made. (Knapp-USGS) W71-09269

# REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.

Tri-County Regional Planning Commission, Peoria,

For primary bibliographic entry see Field 05D. W71-09356

## COMPREHENSIVE PLANNING IN THE SOUTHEAST, Federal Power Commission, Washington, D.C.

G. E. Tomlinson.

Proceedings of the American Society of Civil Engineers Journal of the Hydraulics Division, Vol. 91, No HY5, Sept. 1965, p. 81-105, 4 tab., 2 fig.

Descriptors: \*Water resources, \*Flood control, \*Planning, \*Economics, Evaluation, Interest rates, Benefits, Costs, Financing, Multiple-purpose planning, Formulation, Rivers, Decision making, Investment.

Investment. Identifiers: \*Comprehensive planning, \*Commission organization, Framework, Assumptions, Objectives, Policy decision, Criteria, Guideline, Single-purpose planning.

This article dealt with the many problems that arise in connection with the planning, development, control, and use of water and land resources in the Southeast River Basins. Commission organization policy decisions, objectives and guidelines, economic framework, assumptions, and criteria were discussed. In projection formulation, both tangible and intangible effects were considered. Cost and benefits were presented in monetary terms to the extent practicable and, beyond that, the effects were discussed in narrative terms. Projects and programs were specifically formulated to serve all of the conventional purposes plus recreation and pollution abatement. Costs were allocated to all purposes, using standard allocation procedures. The plan was designed to meet projected needs as determined by the use of an economic model. The proposed developments individually and collectively, will produce benefits in excess of costs. The major part of the cost will be borne by nonfederal interests. (Wang-Rutgers) W71-09418

#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

#### ESTIMATION DEVIATIONS: THEIR EFFECT UPON THE BENEFIT-COST RATIO,

Oklahoma Univ., Norman; and Iowa State Univ.,

For primary bibliographic entry see Field 06B. W71-09059

# IDENTIFICATION AND INTERRELATION-SHIPS OF SECONDARY BENEFITS IN WATER-WAYS DEVELOPMENT, Auburn Univ., Ala. Water Resources Research

For primary bibliographic entry see Field 06B. w7i-09269

#### BENEFITS AND BENEFICIARIES: CONTRAST-ING ECONOMIC AND CULTURAL DISTINC-

State Univ., Corvallis. Dept. of Oregon

Anthropology.
Thomas C. Hogg, and Courtland L. Smith.

Water Resources Research, Vol 7, No 2, p 254-263, Apr 1971. 3 figures, 21 references.

Descriptors: \*Water resources development, \*Cost-benefit analysis, \*Project planning, Multiple purpose projects, Social function.
Identifiers: \*Salt River Valley of Arizona, Pacific Northwest, Kalahari desert of Africa, U.S. Forest

The values a society holds regarding effective development of water resources must be considered in the decision making process. Cettain peoples have certain needs and necessities and each relates to a benefit-cost relationship differently. Our value system tells us what is desired. Three test areas, Pacific Northwest, Arizona, and the Kalahari desert in Africa show interesting differences that are significant in the cultural values for water resource differences. (Campbell-Rutgers) W71-09392

#### WATER BILLS AND COMPUTERS,

Arizona State Water and Sewer Dept., Phoenix. Jack W. Blaha.

Journal American Water Works Association, Vol. 62, No. 10, p 603-5, October 1970. 2 tables, 1

Descriptors: \*Computer programs, \*Data processing, \*Water rates.
Identifiers: \*Phoenix, \*Billing system.

In the light of the rapid changes in technology and the growth rate acceleration, the author points up the need for a computerized billing system for water, with emphasis on efficiency. (Campbell-Rutgers) W71-09405

#### ECONOMICS OF COMPOSTING MUNICIPAL REFUSE IN EUROPE AND ISRAEL,

American Public Health Association, New York. For primary bibliographic entry see Field 05E. W71-09417

#### 6D. Water Demand

#### HYDROLOGIC AND QUALITY CHARACTERISTICS OF THE LOWER MISSISSIPPI RIVER.

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 02E. W71-09103

#### MODELING REGIONAL ECONOMIC AND EN-VIRONMENTAL INTERRELATIONSHIPS

Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.

D. C. Sweet.

Tranactions of the American Nuclear Society, Vol 13, No 1, p 30 (July 1970). 1 fig, 2 ref.

Descriptors: \*Water resources, \*Water management (Applied), \*Environmental engineering, \*Simulation analysis, Water resources development, Computer models, River basins.

A model of the Susquehanna River basin relates the region's economy to its water resources. It is comprised of three interrelated sectors: (1) demographic, (2)employment, and (3) water. The river basin is divided into nine subregions for purposes of economic analysis and the water sector examines certain critical points within each subregion. Each sector of the model is developed for a subregion that interacts with the others. The use of the model is for projecting future economic growth and the impact on water resource development. (Bopp-NSIC)

W71-09248

#### PRELIMINARY EVALUATION OF HYDROLOGIC EFFECTS OF IMPLEMENTING WATER AND SEWERAGE PLANS, DADE COUNTY, FLORIDA,

Geological Survey, Miami, Fla. F. W. Meyer. Geological Survey Open-file Report 71003, 1971. 110 p, 19 fig, 17 tab, 51 ref.

Descriptors: \*Water supply, \*Urbanization, \*Sewage disposal, \*Florida, \*Water resources development, Municipal water, Water balance, Planning, Aquifers, Water utilization, Hydrogeology, Land use, Consumptive use, Water demand. Identifiers: \*Dade County (Fla), \*Miami (Fla).

As urbanization continues in Dade County, Florida, water requirements will increase. If present trends continue, by the year 2020 the total demand for water supplies in Dade County will average 760 mgd. About 12 mgd will be pumped to the Florida Keys. By year 2020, 540 mgd of waste water will be discharged from power to the water will be discharged from sewers to the ocean. With increasing runoff and sewage discharged to the ocean, the total consumptive use of water will ultimately exceed the region's developed water supply capability. By 1976, available fresh water may be insufficient to satisfy all competing demands, according to recent projections by the U.S. Corps of Engineers (1968), unless plans for increasing the efficiency of water use are effected. Plans include reduction in storm runoff by largescale backpumping to Lake Okeechobee and the conservation areas. Other alternatives include separation of storm and sanitary drainage systems and the prevention of fresh water leakage into the sanitary sewer system. (Knapp-USGS) W71-09334

#### 6E. Water Law and Institutions

## TOWARDS BETTER ADMINISTRATION OF WATER QUALITY CONTROL,

For primary bibliographic entry see Field 05G. W71-08979

#### GRANTS FOR CONSTRUCTION OF TREAT. MENT WORKS.

Federal Register, Vol 35, No 62, p 5346-5347, Mar 1970. 2 p.

Descriptors: \*Administrative agencies, \*Regulations, \*Sewage, \*Water pollution control, Pollutants, Pollution abatement, Water pollution treatment, Sewage treatment, Administration, Administrative decisions, Water pollution, Federal government, Government finance, Grants, Treatment.

#### Water Law and Institutions—Group 6E

New rules proposed by the Interior Department pertaining to grants for construction of treatment works are intended to provide greater assurance that the quality of treated water will be improved. The following requirements are proposed to achieve that objective: (1) treatment works must be included in a basin-wide, metropolitan, or regional pollution abatement plan; (2) operation must conform to requirements for industrial waste treatment; and (3) efficiency, economy, and effectiveness will be achieved by design and periodic inspection. Information which may be required by the Commissioner includes: (1) sources of pollution; (2) volume of discharge; (3) character of effluent; (4) present treatment; (5) water quality effect; and (6) detailed abatement program. No grant will be made under the new rules if the project is intended to treat industrial waste, rather than the wastes of the entire community or region concerned. Where industrial wastes are treated by the project, an equitable system of cost recovery must be effected. All projects must be inspected annually during the first three years and periodically thereafter. (Hart-Florida)

RANSOMING THE MAINE ENVIRONMENT, For primary bibliographic entry see Field 05G. W71-08981

CONSTITUTIONAL DILEMMAS POSED BY STATE POLICIES AGAINST MARINE POLLUTION--THE MAINE EXAMPLE, For primary bibliographic entry see Field 05G. W71-08982

WATER POLLUTION CONTROL UNDER THE REFUSE ACT OF 1899,

For primary bibliographic entry see Field 05G. W71-08983

PREVENTION, CONTROL, AND ABATEMENT OF AIR AND WATER POLLUTION AT FEDERAL FACILITIES,

Richard M. Nixon. Exec Order No 11507, Federal Register, Vol 35, No 25, p 2573-2576 (Feb 1970). 4 p.

Descriptors: \*Water pollution control, \*Air pollution, \*Pollution abatement, \*Federal government, Administrative agencies, Administrative decisions, Administration, Federal project policy, Water resources, Regulation.

Identifiers: \*Clean Air Act, \*Federal Water Pollution Control Act.

In order that the federal government may provide leadership in the design, operation, and main-tenance of its facilities in the nationwide effort to protect and enhance the quality of air and water resources, the President's executive order directs compliance with air and water quality standards at federal facilities. Heads of federal administrative agencies are directed to publish procedures to ensure that their facilities comply with the order, and to maintain surveillance to ensure that the standards are met on a continuing basis. The Council on Environmental Quality must review and report implementation of the order to the President. Generally, the standards prescribed are those adopted pursuant to the Clean Air Act and the Federal Water Pollution Control Act. Certain facilities may be exempted from the requirements in the national interest. The implementation date is December 31, 1972. The order also establishes standards for new federal facilities and procedures for federal water resources projects. (Hart-Florida)

COLLECTION OF STEAM-ELECTRIC GENERATING PLANT POLLUTION CONTROL DATA.

Federal Register, Vol 35, No 29, p 2832-2833 (Feb 1970). 2 p.

Descriptors: \*Water pollution control, \*Air pollution, \*Pollution abatement, \*Federal government, Thermal pollution, Federal Power Act, Electric power, Administrative agencies, Water pollution.

The Federal Power Commission publishes notice of proposed rule making. The proposal would require submission of information designed to provide a basis for the development of effective environmental quality programs in coordination with the National Air Pollution Control Administration and the Federal Water Pollution Control Administration. The information form proposed is designed to obtain information as to the fuel quality used in fossilfueled steam electric generating plants of 25 or more megawatts and other data relating to atmospheric emissions and thermal pollution. Although the form was originally formulated for distribution only to selected utilities, it is now contemplated for reports from all steam-electric plants. The new form reflects the increased federal concern for preservation of air and water resources. The report is to be submitted every fifth year. Comments by interested persons must be forwarded to the Federal Power Commission by March 2, 1970. (Hart-Florida)

INDUSTRIAL POLLUTION CONTROL, Fred A. Clarenback. 112 Cong Rec 11719-11721 (1966). 3 p.

Descriptors: \*Water pollution control, \*Pollution abatement, \*Industries, \*Administration, Water pollution, Water pollution treatment, Industrial wastes, Effluents, Cities, Administrative agencies, Water pollution sources, Non-structural alternatives, Pollutants, Water quality control. Identifiers: \*Effluent charges.

In 1966, a senator advocating a system of economic incentives to encourage industries to abate pollution placed a paper into the Congressional Record concerning the hidden costs of industrial pollution and the use of effluent charges to encourage industry to abate pollution. The paper is entitled 'Incentives for Industrial Pollution Control'. The author postulates first that single companies find the costbenefit ratio of pollution control unsatisfactory, because the benefits to downstream riparians are not included in the calculations. However, the overall cost to the public of failure to begin pollution abatement is found to be much higher than the cost to the single industry. It is observed that forestalling assertion of public authority for pollution is an incentive for voluntary pollution abatement, but voluntary abatement has been unsuccessful. The author advocates establishing 'pollution quotas' among cities and industries, enforceable by effluent charges, to achieve an acceptable standard of stream water quality. The charges would vary inversely with the relationship of pollution to the quality standard. The advantages of the effluentcharge system are stated to be: (1) free choice by industry; (2) inducement to develop low cost pollution control measures; and (3) flexibility. (Hart-Florida) W71-08986

REGULATION OF PUBLIC USE OF RESERVOIR AREAS.

Corps of Engineers, Washington, D.C.

Code of Federal Regulations, Title 36, Chap III, Part 311 (1970). 7 p.

Descriptors: \*Reservoirs, \*Public rights, \*Regulation, \*Administrative agencies, Administration, Water resources development, Recreation, Boating, Swimming, Hunting, Fishing, Environmental sanitation, Public health, Water pollution, Sewage, Wastes, Federal government, State governments, Permits, Navigable waters, Access routes, Boats, Boating regulations, Water supply.

These regulations issured by the Department of the Army govern public use of certain reservoir areas with respect to such matters as: (1) various boating

activities, (2) swimming, (3) hunting, (4) fishing, (5) camping, (6) access to water areas, (7) pollution of waters, (8) sanitation, and (9) recreational activities. The regulations first list the states and projects within the states to which they are applicable. Commercial boating is prohibited except as specifically authorized by the Department of the Army. Private boating on reservoirs for fishing and recreational use is permitted except where prohibited by the District Engineer. Various sections cover such things as safety of boats and types of boats permitted on reservoir waters. All boats must be securely moored when not in use. No vessel shall discharge sewage, garbage, or other pollutants into the waters of a reservoir, except in ac-cordance with state and local health agency standards permitting such discharges in deep waters. Swimming and bathing are permitted except in areas designated by the District Engineer. The regulations list the requirements for hunting and fishing and the areas where such activity may be prohibited. Rights of public access to water areas are enumerated. No refuse or wastes may be deposited in reservoir areas except at designated points or places designed for sanitary disposal. (Duss-Florida)
W71-08987

LIABILITY FOR OIL POLLUTION CLEANUP AND THE WATER QUALITY IMPROVEMENT ACT OF 1970,

For primary bibliographic entry see Field 05G. W71-08988

THERMAL ELECTRIC POWER AND WATER POLLUTION: A SITING APPROACH, For primary bibliographic entry see Field 05G. W71-08989

WHO'S RESPONSIBLE FOR POLLUTION, James Marshall.

American Bar Ass'n Journal, Vol 57, p 21-26 (1971). 6 p.

Descriptors: \*Water pollution, \*Pollution abatement, \*Environmental effects, \*Legal aspects, Legislation, Remedies, Environment, Ecology, Air pollution, State governments, Federal government, Local governments, Technology, Navigable waters, Scwage, Natural resources, Water supply, Pesticides, Administrative agencies, Water pollution sources, Industrial wastes, Costs, Damages, Balance of nature.

Identifiers: Refuse Act, \*Administrative Procedure Act, \*National Environmental Policy Act.

Considering the great threat posed to our society by various types of pollution, this article concentrates its attention on the legal responsibility for pollution and the legal safeguards which exist or should be enacted in order to prevent pollution. The author first considers the interrelationship of different polluters and the cumulative effect which various types of pollution have upon our environment. Different branches of government, industry, and consumers receive attention. In the past, corporations and governments have omitted from their balance sheets the cost to the nation resulting from activities which damage our environment. There is need to enact legislation which sets deadlines for cleaning up and preventing pollution. Legal remedies through court action provide one avenue for successful pollution control. The Refuse Act of 1899 is one example of legislation which provides for redress against polluters of navigable waterways. The author considers injunctive relief the best remedy for pollution damage. Several types of cases are cited and there is a discussion of the need to expand plaintiff's rights. The article concludes with a consideration of the Administrative Procedure Act and the National Environmental Policy Act, both of which may be of service in pollution control. (Duss-Florida) W71-08990

## Field 06-WATER RESOURCES PLANNING

## Group 6E—Water Law and Institutions

THE PORTER-COLOGNE WATER QUALITY CONTROL ACT.
California State Water Resources Control Board,

Sacramento, Calif.

For primary bibliographic entry see Field 05G. W71-08991

CLEAN LAKES ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT).

Senate Bill 1017, 92d Cong, 1st Sess (1971). 9 p.

Descriptors: \*Water pollution control, \*Lakes, \*Grants, \*Treatment facilities, Water pollution, Water pollution sources, Water treatment, State governments, Federal government, Administrative agencies, Water quality, Water quality control, Discharge (Water), Cities, Legal aspects, Pollutants, Pollution abatement, Financing. Identifiers: \*Clean Lakes Act.

The proposed Clean Lakes Act of 1971, a bill to amend the Federal Water Pollution Control Act, is designed to improve the quality of fresh water navigable lakes in both urban and rural areas, with special emphasis upon small community lakes. The Administrator of the Environmental Protection Agency is authorized to increase state grants for modern treatment works discharging into lakes where enforceable water quality standards have been approved by the Administrator. One-hundred fifty million dollars is appropriated for the increased grants. Additionally, technical and finan-cial assistance may be provided for approved pollu-tion abatement programs for lakes. Various criteria for approving applications are promulgated. Furthermore, appropriations and provisions for the Secretaries of Agriculture and the Army to furnish personnel, services, and facilities at state request are given. Discharge of waters into approved lakes in violation of established water quality standards is prohibited. Knowing violation is a criminal offense, and penalties are prescribed. Provisions for civil relief by injunction or restraining order are also given. (Hart-Florida) W71-08992

A BILL TO AMEND THE PUBLIC HEALTH SERVICES ACT TO PROHIBIT THE DISCHARGE OF ELEMENTAL MERCURY AND ITS COMPOUNDS INTO ANY WATERS OF THE UNITED STATES WHICH DIRECTLY AFFECT THE PUBLIC HEALTH.

House Bill 130, 92d Cong, 1st Sess (1971), 3 p.

Descriptors: \*Public health, \*Chemical wastes, \*Water pollution sources, \*Discharge (Water), Inorganic compounds, Metals, Toxins, Legislation, Water pollution, Pollution abatement, Pollutants, Water pollution control, Water quality, Water quality control, United States, Administration, Administrative agencies, Legal aspects, Regulation, Federal government.

Discharge of elemental mercury or mercury compounds into any United States waters is prohibited by this proposed amendment to the Public Health Services Act. All previous licenses, permits, or authorizations for discharge of mercury com-pounds or mercury are terminated, and further authorization may not be granted. A fine of \$10,000 may be imposed for violation of the Act, for continuing violations, each day is a separate offense. Furthermore, federal district courts are given authority to restrain violation, and failure to obey a court order is punishable as contempt. (Hart-Florida) W71-08993

EMERGENCY WATER POLLUTION PREVENTION ACT OF 1971 (A BILL TO ESTABLISH AN IMMEDIATE PROGRAM FOR THE PREVENTION OF OCEAN POLLUTION). Senate Bill 1286, 92d Cong, 1st Sess (1971). 4 p.

Descriptors: \*Water pollution, \*Oceans, \*Waste disposal, \*Water quality control, United States, Federal government, Legislation, Legal aspects, Water pollution control, Pollution abatement, Pollutants, Administrative agencies, Contiental shelf, Admiralty, Ships, Regulation.

Loading of vessels with any material for ocean disposal would be immediately prohibited by this proposed amendment to the Federal Water Pollution Control Act. The bill is entitled the Emergency Water Pollution Prevention Act of 1971. Further regulations would be promulgated by the Administrator of the Environmental Protection Agency to govern issuance of permits for ocean disposal only when it is not harmful to the environment and is beyond the Continental Shelf and United States waters. The civil penalty for violation of the Act is a \$25,000 fine; vessels are liable in rem for the civil penalty. The terms 'master', 'owner', 'ocean waters', and 'vessel' are defined in the Act. (Hart-W71-08994

#### OIL SPILL PREVENTION AND POLLUTION CONTROL.

Fla Stat Ch 376 (Supp 1970). 7 p.

Descriptors: \*Florida, \*Water pollution, \*Oil, \*Administrative agencies, Legislation, Regulation, Pollution abatement, Pollutants, Water pollution control, Water quality, Water quality control, Ships, Oily water, State governments, Damages, Adminstration.

The Oil Spill Prevention and Pollution Control Act complements federal legislation in the same area. The Act states the duties of the department of natural resources and provides definitions of crucial terms. Discharge of all petroleum products in coastal waters is prohibited. Operation of unlicensed terminal facilities is prohibited. The regulatory powers of the department of natural resources are set forth; the department is directed to promulgate certain regulations. The Act also prescribes the duties of port managers in preventing oil pollution by vessel inspection. Moreover, persons making prohibited discharges are directed to remove the prohibited materials to the department's satisfaction. Other provisions for removal of prohibited discharges are established. The department is directed to maintain sufficient personnel and equipment to implement the Act's requirements. The Florida Coastal Protection Fund is established to implement the Act. Licensees are liable to the state for costs of clean-up activities resulting from prohibited discharges. Other provisions include: (1) bonding requirements for vessels and terminal facilities, (2) derelict vessels, (3) enforcement and penalties, (4) legislative reports, (5) budget approval, (6) limitation on local ordinances, (7) limitation on application of the Act, and (8) the governor's emergency powers. (Hart-Florida) W71-08995

HEINZ V BOROUGH OF ESSEX FELLS (CITY'S LIABILITY FOR DISCHARGING OIL INTO STREAM

151 A 593-594 (Ct Err and App NJ 1930).

Descriptors: \*New Jersey, \*Water pollution, \*Oil, \*Cities, Water pollution effects, Water pollution sources, Water quality, Pollutants, Legal aspects, Judicial decisions, Oily water.

Plaintiff farmowner sued defendant city for damages from stream pollution. The stream was unfit for consumption by domestic animals, and the oil in the stream had ignited and burned the fence in plaintiff's pasture. Discharge from a pumping station was the primary source of the oil, but some pumping station oil was also dumped on nearby roads and could have been washed into the stream. Following a lower court verdict for plaintiff, defendant objected to a jury charge which stated that defendant had no right to discharge oil from its pumping plant into the stream or upon the roads to plaintiff's detriment. Defendant asserted the charge deprived it of the exemption of municipalities from liability for governmental functions. The New Jersey Court of Errors and Appeals held that the charge was proper and stated the general rule to be that a municipality is immune from liability for strictly governmental functions only when it is free from any active wrongdoing. (Hart-Florida) W71-08996

AN ACT RELATING TO SANITARY SEWAGE DISPOSAL UNITS: OCEAN OUTFALL AND DISPOSAL WELL TREATMENT REQUIRE-MENTS.

Fla Laws ch 70-82, p 199-200 (1970), 2 p.

Descriptors: \*Florida, \*Water pollution control, \*Treatment facilities, \*Sewage disposal, Legislation, Legal aspects, Disposal, Treatment, Ultimate disposal, Municipal wastes, Supervisory control (Power), Organic wastes, Pollutants, Sewage effluents, Sewage sludge, Waste water (Pollution), Environmental sanitation, Pollution abatement, Sanitary engineering, Oceans, Administration, Administrative agencies, Administrative decisions, Adoption of practices, State jurisdiction.

No state agency, county, special district, or municipality shall approve construction of sanitary sewage ocean outfalls or disposal wells not providing for secondary treatment of wastes. Additional advanced treatment may be ordered by the Department of Air and Water Pollution. Existing outfalls and wells shall provide secondary and necessary additional advanced treatment by January 3, 1974.
Failure to conform shall be punishable by a five hundred dollar fine for each twenty-four hours, or fraction therof, of continued violation. (Earl-Florida) W71-08999

TAX CREDITS FOR EXPENDITURES ON POL-LUTION ABATEMENT FACILITIES.

Public Act No 291, Connecticut Legislative Service, p 317-318 (1969). 2 p.

Descriptors: \*Connecticut, \*Taxes, \*Pollution abatement, \*Waste treatment, Water pollution, Water pollution control, Water quality, Water quality control, Industrial wastes, State governments, Financing, Costs, Equipment.

Five per cent of expenditures for construction, rebuilding, acquisition, or expansion of facilities for treatment of industrial waste shall be allowed as tax credits in the year of expenditure under this recently enacted Connecticut legislation. If the credit allowed exceeds the amount of pre-credit tax, the excessive amount may be carried over into the succeeding four years. (Hart-Florida) W71-09016

REGULATION OF DRILLING FOR AND DISPOSAL OF SALT WATER.

Act 111, Acts of Arkansas, p 316-318 (1969). 3 p.

Descriptors: \*Arkansas, \*Drilling, \*Saline water, \*Wells, Permits, Natural gas, Oil, Regulation, Drainage, Public health, Water pollution, Administrative agencies, Legislation, Scepage, Water pollution control.

Amending the Arkansas act relating to the regulation of drilling for and disposal of salt water, this Act empowers the Arkansas Oil and Gas Commission to regulate such activities. With respect to oil and gas development it is the purpose of the Act to prevent within each developed unit such reasonably avoidable drainage as is not equalized by counter drainage. With respect to well drilling for the production and disposal of salt water, the Commission shall have jurisdiction and authority over all persons and property to the extent necessary to effectuate the purposes of the Act. Among the purposes of the Act are: (1) to require operators to obtain permits from the Commission before drilling for salt water; (2) to regulate drilling methods so as to prevent the escape of salt water out of one stratum into another, the intrusion of salt water into oil and gas strata, and the pollution of fresh water supplies by salt water; (3) to require the making of reports to the Commission regarding drilling; and (4) to regulate other aspects of drilling in order to minimize the dangers involved with regard to natural resources and public safety. (Duss-Florida) W71-09031

AN ACT TO PROHIBIT THE SURFACE DISCHARGING SALTWATER ON THE SURFACE OF LANDS; TO PROHIBIT TAX DEDUCTIONS TO THOSE WHO DISCHARGE SALTWATER: AND FOR OTHER PURPOSES.

Act 254, Acts of Arkansas, p 795-796 (1969). 2 p.

Descriptors: \*Arkansas, \*Oil industry, \*Encroachment, \*Water pollution sources, Well regulations, Saline water-freshwater interfaces,

Seepage, Wells, Mining, Oil wells, Salinity, Legislation, Taxes, Secondary recovery (Oil), Injection, Oil fields, Oil, Saline water, Groundwater, Freshwater, Streams, Water pollution control, Pollution abatement, State governments, Legal aspects.

Under this Act, tax deductions are denied oil-well operators who allow injected saltwater to escape and enter streams. The Act is applicable to individuals, partnerships, and corporations or employees who willfully or negligently cause or permite saltwater to flow, seep, or otherwise escape from leased premises. Any individual can file a complaint and secure a hearing before the Pollution Control Commission for violations of this Act. Upon a finding that the accused has violated this Act tax deductions, under Acts 57 and 138 of 1959, shall be denied for one year. Any violation during a period of suspension shall extend the suspension for one year from the last violation. Should any stream contain more than 250 parts per millionth of chlorides, the Pollution Control Commission shall seek and take steps to climinate the source of such pollution. (Earl-Florida) W71-09040

FRANCHISE TAX DEDUCTIONS FOR COST OF ANTI-POLLUTION DEVICES, SYSTEMS AND FACILITIES.

Act No 1138, Acts of Alabama p 2126-2128 (1969). 3 p.

Descriptors: \*Alabama, \*Taxes, \*Pollution abatement, \*Treatment facilities, Water pollution, Air pollution, Water pollution control, Water pollution treatment, Government finance, Tax rate, State governments, Legislation, Industries, Legal aspects, Financing.

For purposes of computing the franchise tax on foreign corporations, a prior act is amended to include new deductions for anti-pollution devices. The cost of all devices, systems and facilities used or placed in operation in the state primarily for the protection of the public interest through the abatement of air and water pollution shall be allowable as deductions in computing the franchise tax. (Smiljanich-Florida) W71-09042

STATE SALES TAX EXEMPTION FOR PROCEEDS FROM THE SALE OF ANTI-POL-LUTION DEVICES, MATERIALS, SYSTEMS AND FACILITIES.

Act No 1139, Acts of Alabama, p 2128-2131 (1969). 4 p.

Descriptors: \*Alabama, \*Taxes, \*Pollution abatement, \*Prices, Treatment facilities, Water pollution, Air pollution, Water pollution control, Water pollution treatment, Government finance, Tax rate, State governments, Income, Net income, Costs, Assessements, Legislation, Industries, Legal aspects, Financing.

A prior act exempting certain items from state sales taxation is hereby amended to include exemptions for the sale of anti-pollution devices or materials. In computing the amount of state sales tax levied, the gross proceeds from the sale of all devices, materials, systems or facilities used or placed in operation in the state primarily for the protection of the public interest through the abatement of air and water pollution shall be exempted from taxation. (Smiljanich-Florida) W71-09064

WATER LAW: BACKGROUND AND TRENDS, Arizona Univ., Tucson.

R. E. Clark.

Paper National Meeting, American Society of Civil Engineers, Technical Sessions of the Sanitary Engineering Division, Phoenix, Ariz, Jan, 1971. 25 p, 55 ref.

Descriptors: Laws, \*Legal aspects, \*Legislation, Groundwater, \*Water law, Water conservation, Groundwater depletion, Groundwater management, Water allocation (Policy), Administration, \*Water management (Applied), Water pollution, Water quality, Water resources, Bibliographics, Water rights, Interstate compacts, Appropriation (Water rights), Agriculture.

(Water rights), Agriculture.
Identifiers: Water availability, Colorado River
Compact, National Water Resources Council, Central Arizona Project.

Water laws have evolved or have been refined through successive approximations, more inclusive generalizations, and verified hypotheses. The first water laws in the US emerged from common law and practices of miners, farmers, and pioneers. Most water laws have grown unevenly out of necesity, compromise, and pressure. Water laws in several states do not take into account groundwater or the interrelationship between surface and groundwater, and until a few years ago, all but ignored water quality. Today there is good reason for reexamination of the water resources policy. Problems of uneven distribution of supply and shortages, allocation, preferences, waste, quality, and monopoly require more attention. Trends toward improvement can be seen in some of the problem areas. (USBR)

LIGHTNER V CITY OF RALEIGH (DAMAGES FROM SEWAGE EMPTIED INTO CREEK ADJACENT TO PRIVATE PROPERTY).

206 NC 496, 174 SE 272-278 (1934).

Descriptors: \*North Carolina, \*Waste water (Pollution), \*Sewage disposal, \*Municipal wastes, Cities, Judicial decisions, Legal aspects, Damages, Remedies, Flood damage, Easements, Prescriptive rights, Streams, Degradation (Stream), Streamflow, Water pollution, Water pollution sources, Waste water disposal, Waste disposal, Scwage.

Plaintiff landowners sucd defendant city for damages resulting from the emptying of sewage into a creek adjacent to their property. Defendant was using this creek as a sewage outlet when plaintiffs purchased the land, but many new sewage outlets into the creek were constructed after plaintiffs' acquisition of the land. During rains or floods raw sewage was deposited on plaintiffs' land. Defendant argued that it had acquired a prescriptive right to dump sewage in the creek and that plaintiffs' claim was barred by the statute of limitations. Defendant also maintained that it had an easement. The jury rendered a verdict for defendant. The Supreme Court of North Carolina affirmed, holding that a verdict on conflicting evidence is binding on appeal. The court also found that plaintiffs were enti-tled to sue for permanent damage but were limited by the statute of limitations to damages suffered within three years prior to the commencement of the action. The measure of permanent damages would be the difference in value of the land before and after the alleged damage. (Robinson-Florida) W71-09085

TOWN OF SMITHFIELD V CITY OF RALEIGH (CITY'S DISCHARGE OF RAW SEWAGE INTO ANOTHER CITY'S WATER SOURCE). 207 NC 597, 178 SE 114-116 (1935).

Descriptors: \*North Carolina, \*Water pollution sources, \*Water supply, \*Sewage disposal, Judicial decisions, Legal aspects, Wastes, Waste disposal, Waste water (Pollution), Waste water disposal, Water pollution, Water rights, Water sources, Water resources, Water utilization, Water users, Sewage, Sewers, Streams, Rivers, River flow, Cities, Remedies, Legislation.

Plaintiff town brought an action to enjoin defendant city from discharging untreated sewage into creeks that fed the Neuse River, from which plaintiff derived its water supply. Defendant had no modern sewage treatment plant, and the discharge of raw sewage was a statutory violation. Plaintiff operated a water treatment plant which extracted and treated water from the river. Defendant was a much larger city than plaintiff and plaintiff had not suffered harm. Plaintiff alleged that such discharges were a menace to the health of its citizens, and defendant alleged that there was no menace or detriment to plaintiff. The trial court denied plaintiff's petition. The Supreme Court of North Carolina affirmed, after weighing the relative hardships of the inhabitants of both cities. The court further held that defendant must comply with the statute prohibiting such discharges even though temporarily excused because of financial conditions. Actual injury is not required to enjoin a municipality from discharging raw sewage into another town's water source; a threat of harm is sufficient. (Robinson-Florida)

KELLUM V VILLAGE OF GREENUP (UNRECORDED EASEMENT TO DISCHARGE SEWAGE).

265 III App 24-26 (1932).

Descriptors: \*Illinois, \*Pollution abatement, \*Easements, \*Municipal wastes, Fouling, Odor, Scwage sludge, Scwers, Scwage disposal, Water rights, Scwage effluents, Water pollution, Pollutants, Legal aspects, Judicial decisions, Scwage, Fresh water.

Plaintiff landowner sought to enjoin defendant village from discharging scwage into an open water-course on property which she operated as a dairy. Defendant operated a sewer which emptied into an open stream crossing plaintiff's land. The evidence showed that the stream became so polluted that: (1) the cows crossing the stream had to be cleaned before they could be milked; (2) deposits of sewage and sludge beds were formed on the land and, at times, emitted an offensive odor; and (3) plaintiff had made numerous complaints to defendant. Defendant claimed that it had purchased an easement from the former owners before they sold the land to plaintiff. The alleged easement granted to defendant the right to carry sewage across the premises.

The evidence showed that such an easement was never recorded and plaintiff had no knowledge of it. The easement granted only the right to lay the sewer across plaintiff's land and did not give defendants the right to run the sewage into the open stream. The Appellate Court of Illinois found that the evidence supported the trial court's granting of the injunction. An unrecorded easement was held to be no defense to such an action. (Johnson-Florida) W71-09155

MILLER V MOBILE AND OHIO RR (INADEQUATE DRAIN BENEATH RAILROAD EMBANKMENT).

265 111 App 414-420 (1932).

Descriptors: \*Illinois, \*Floods, \*Obstruction to flow, \*Storm runoff, Repulsion, Tile drainage, Rain water, Legal aspects, Judicial decisions, Watersheds (Basins), Water rights, Drainage systems, Flood control, Flood damage, Maximum

### Field 06-WATER RESOURCES PLANNING

## Group 6E—Water Law and Institutions

probable flood, Precipitation excess, Streams, Runoff, Drainage, Drains.

Plaintiff's land was in a basin bordered on one side by defendant railroad's embankment. A stream passed under the railroad north of plaintiff's land. passed under the railroad north of present and previously been sufficient to allow any overflow to pass through. Defendant later filled the trestle with carth and constructed a five-foot drain to carry the water through the embankment. The drain was in-sufficient to carry the natural flow of water resulting from frequent rains over a short period. Plaintiff's land was flooded, and he sued for the damages. The U.S. Appellate Court of Illinois held that there could be no recovery for damages if the rains were unprecedented acts of God, unless derains were unprecedented acts of ode, union of the damage. The jury found that the rains were not unprecedented and the court felt that the use of the five-foot drain in place of the trestle might have been negligent. One who restrains the flow of water must provide for the consequences of heavy rainfall and will be liable if he fails to do so. (Johnson-Florida) W71-09162

#### LOVE V NASHVILLE AGRICULTURAL AND NORMAL INSTITUTE (MEASURE OF DAMAGES FOR SPRING POLLUTION). 6 Tenn App 104-111 (1927).

Descriptors: \*Tennessee, \*Springs, \*Water pollution, \*Damages, Water pollution sources, Water pollution effects, Pollutants, Sewage, Rent, Mineral water, Spring waters, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction to prevent defendant school from discharging sewage so that his sulfur spring was contaminated and damages for both loss of profits from sales of the sulfur spring water and depreciation of this property. From a lower court decision holding defendant liable, both parties appealed on the measure of damages. Plain-tiff contended that the lower court should have considered damages for diminished reputation of his spring water, depreciated property value, and lost profits from water sales. Conversely, defendant contended that the chancellor did not consider contamination from other sources, and that he erred in holding that defendant must prove contamination from other sources. The Tennessee Court of Appeals held that plaintiff could not obtain the special damages, since they were not pleaded and proven. As to defendant's assignments of error, the court held that defendant had the burden of proving other sources of contamination and what portion of the injury was caused by other sources. General rules for measuring damages for both permanent and temporary injuries were outlined by the court. (Hart-Florida)
W71-09166

#### FIRST TRUST CO V PEPPER BROS (RECOVERY OF DAMAGES FOR DESTRUC-TION OF ICE CROP BY OIL POLLUTION). 235 App Div 750, 256 NYS 752-753 (1932).

Descriptors: \*New York, \*Ice, \*Oil, \*Damages, Water pollution, Impaired water quality, Gasoline, Water pollution sources, Industrial wastes, Oily water, Judicial decisions, Legal aspects, Water pollution effects.

Plaintiff brought suit to recover damages for injury to his ice crop. These damages were allegedly sustained by reason of defendant's permitting lubricating oil from its gasoline pumps to enter a creek. A verdict for plaintiff was entered at the trial term. On appeal the Supreme Court of New York found sufficient evidence to sustain the verdict for plaintiff as to liability, but not as to the amount of damages. The court stated that the jury could not award damages for water diverted, for loss of domestic water supply, or for loss of plaintiff's customers. The only elements of damage allowable

were loss of ice harvest, loss by extra shrinkage of the ice actually harvested due to failure to fill the icehouse, and the expense of harvesting and insuring such extra shrinkage ice. Upon determination of the value of such damages the court found the award must be reduced. (Barnett-Florida) W71.00169

#### CITY OF HARRISONVILLE V W S DICKEY CLAY MFG CO (REMEDY FOR MUNICIPAL POLLUTION OF PRIVATE PROPERTY). 289 US 334, 53 S Ct 602-605 (1933).

Descriptors: \*Missouri, \*Municipal wastes, \*Sewage treatment, \*Sewage effluents, Remedies, Judicial decisions, Legal aspects, Damages, Streams, Local governments, Farms, Sewage disposal, Pipes, Water pollution, Water pollution sources, Pumping plants, Cities.

Plaintiff manufacturing company sought damages from defendant city and an injunction to stop defendant from discharging effluent into a creek on a stock farm plaintiff owned. Defendant had removed 60 per cent of the organic matter from the effluent and it would cost \$30,000 to build a secondary treatment plant to remove another 30 per cent of the matter. The lower appellate court barred an injunction, and plaintiff appealed, contending that the injunction should be granted because the discharge constituted a permanent nuisance. Defendant argued that damages for depreciation in property value was the proper remedy. The United States Supreme Court held that the discharge was a nuisance, but that in this case an injunction was not the proper remedy because it would work disproportionate hardship on defendant. The farm's loss in rental value could be remedied by money damages. The Court also held that the disposal plant was not a permanent nuisance since secondary treatment could be added. The case was remanded for determination of damages. (Morris-Florida) W71-09170

# FRANK TEA AND SPICE CO V L SCHREIBER AND SONS CO (PROPERTY DAMAGES FROM BLOCKAGE OF SEWER BUILT TO REPLACE NATURAL STREAM).

20 Ohio App, 151 NE 801-802 (1925).

Descriptors: \*Ohio, \*Municipal wastes, \*Sewers, \*Drainage systems, Legislation, Cities, Storm drains, Sewage disposal, Flood damages, Surface waters, Running waters, Natural streams, Waste disposal, Pumping, Riparian rights, Easements, Environmental sanitation, Public health, Waste disposal.

The city of Cincinnati built a drain running through all property bordering on Deer Creek. The creek was filled and the drain lay 50 feet below the surface. The drain was never made a part of the city sewer system, although it was used as a storm drain. Prior judicial opinions clarified the purpose of the drain: to replace the creek by superseding it with a sewer which to each property owner should be a quasi-natural stream, subjecting each to no new obligations. Plaintiff property owner sought to enjoin defendant's dumping sewage into the drain and to recover damages resulting from pumping out his basement, which was flooded as a result of blockage in the drain. The Court of Appeals of Ohio denied recovery of damages, finding that: (1) there was no rational means to assess the amount of damages caused by defendant since his sewage was in small proportion to the volume claimed to have been pumped out; and (2) it was possible that plaintiff failed to use due care while pumping to minimize damages. Defendant was enjoined from using the drain to dispose of sewage, since such use directly contravened the health regulations of the state set forth in a sanitary code. (Rees-Florida)

JOYCE-WATKINS CO V INDUSTRIAL COMM'N (LOW-WATER MARK AS BOUNDARY BETWEEN COTERMINUS STATES).
325 1|| 378, 156 NE 346-349 (1927).

Descriptors: \*Illinois, \*Low water mark, \*Boundaries (Property), Bank erosion, Channel erosion, Rivers, Thread of the stream, Boundary disputes, Kentucky, Railroads, Working conditions, Personel, Employment, Compensation, Accretion (Legal aspects), Ownership of beds, Ohio River.

Defendant employee was injured on plaintiff employer's railway that extended 260 feet into the River at a point 10 feet from the water's edge. Plaintiff contended the injury occurred outside the jurisdiction of Illinois, rendering an Illinois com-pensation award invalid. The Illinois Supreme Court held that the question of a boundary line between Illinois and Kentucky could not be determined, since Illinois was not a party to the action. However, the court did decide that the low-water mark of the river, constituting the boundary between these coterminus states, was not a per-manent line. The court took judicial notice that the Ohio River varies in water level. It ruled that when a stream dividing coterminus states alters its course by a gradual process of alluvion, the boundary shifts with the stream. However, alteration by sudden changes leaves the boundary in the river's middle. Testimony from experienced rivermen established the various levels of the Ohio River; the court concluded that the injury occurred north of the low-water mark. The compensation award by the Illinois Industrial Commission under the state Workmen's Compensation Act was upheld. (Rees-Florida) W71-09176

### NAGY V CITY OF AKRON (MUNICIPAL SURFACE WATER DRAINAGE). 27 Ohio App 250, 161 NE 226-228 (1927).

Descriptors: \*Ohio, \*Surface drainage, \*Storm runoff, \*Surface runoff, Judicial decisions, Surface waters, Laterals, Storm drains, Damages, Drainage, Drainage water, Drainage systems, Legal aspects.

Plaintiff landowner sued defendant city for damages to his crops caused by overflow from a county drainage lateral which passed through plaintiff's land. Plaintiff's complaint alleged that the overflow resulted from defendant's storm water sewer emptying into the lateral at a point 1000 feet outside defendant's corporate limits. The lateral was a watercourse under Ohio law. Defendant denied liability because only the flow and not the drainage area of the lateral had been increased by defendant's storm sewer drainage. The trial court sustained defendant's demurrer and the Court of Appeals of Ohio reversed. The court treated defendant municipality as an individual landowner in applying the civil law rule for surface water drainage. While acknowledging the rule that a landowner may, without liability, drain surface water into a natural watercourse upon his land and thus increase the volume and flow of the watercourse, the court pointed out that the watercourse in the instant case did not at any point come within defendant's corporate limits. The court therefore held plaintiff's complaint to state a cause of action. (Madsen-Florida) W71-09187

## PRIVATE REMEDIES FOR WATER POLLU-

Columbia Law Review, Vol 70, p 734-756, 1970, 23 p, 139 ref.

Descriptors: \*Water pollution control, \*Water quality control, \*Remedies, \*Social impact, Riparian rights, Legal aspects, Water law, Reasonable use, Natural flow doctrine, Water pollution, Water quality, Administration, Administrative agencies, Administrative decisions, Judicial decisions, Water policy, Industrial wastes, Social values, Political aspects, Damages, Legislation.

#### Water Law and Institutions—Group 6E

The following common law bases of a cause of action for water pollution are discussed: (1) riaprian rights, (2) public nuisance, and (3) private nuisance. Recovery of damages and suits for injunctive relief are also considered. Available defenses and their effect on these actions are examined private actions based on statutes and constitutional provisions are next considered. The possibility of challenge by private individuals to administrative action in environmental control is evaluated. Though federal and state pollution programs are becoming increasingly important, private litigation still provides economic and political stimulants to government and industry and fills gaps and furnishes individual remedies where pollution programs lack specificity. Private litigation also points out relevant issues to legislators and administrators. Actions for damages will encourage private industry to reevaluate the social costs of pollution, and class actions can increase this economic pressure. The author concludes that while comprehensive plans must come from the legislature, the courts must educate and coerce compliance with new environmental standards. (Robinson-Florida) W71-09195

# DUMPING GROUND REGULATIONS (REGULATION OF DUMPING IN INTEREST OF NAVIGATION). Code of Federal Regulations, Title 33, Chap 11,

part 205 (1970). 14 p.

Descriptors: \*Navigable waters, \*Navigation, \*Waste disposal, \*Waste dumps, Bodies of water, Regulation, Inspection, Permits, Standards, Monitoring, Administrative agencies, Administration, Water pollution, Pacific Ocean, Atlantic Ocean, Navigable rivers, Great Lakes, Dredging, Wastes, Costs, Federal government.

In an effort to control the dumping of waste materials into various navigable bodies of water, these federal regulations delineate: (1) the types of materials which may be dumped, (2) the areas where they may be dumped, (3) procedures for obtaining permission to dump waste materials, and (4) methods for regulating permissible dumping. Bodies of water covered by these regulations include: (1) New York Harbor and adjacent waters; (2) the Chesapeake Bay off Kent Island, Maryland; (3) Ashley River and Charleston Harbor, South Carolina; (4) Lake Michigan around Chicago, Il-linois; (5) Lake Superior in Minnesota and Wisconsin; (6) the west end of Lake Erie; (7) various approaches to bays and rivers in the Pacific Ocean; and (8) entrances to seaports. The primary aim of the regulations is to assure unhindered navigation in these waters, although pollution control appears to be an additional factor. In all waters covered the dumping of floatable wastes or wastes easily transported by currents is prohibited. In many waters metallic objects may not be dumped. Various provisions prescribe methods of obtaining dumping permits, supervisory control of the dumping, and inspection of dumping areas. (Duss-Florida) W71-09196

#### FEDERAL AID TO STATES IN FISH AND WIL-DLIFE RESTORATION.

Code of Federal Regulations, Title 50, Chap 1, part 80 (1970), 7 p.

Descriptors: \*Government finance, \*Fish management, \*Wildlife management, \*Wildlife conservation, Administrative agencies, Regulation, Grants, State governments, Administration, Contracts, Water pollution, Water pollution control, Pollution abatement, Fish conservation, Federal project policy, Permits, Project planning.

The federal government is authorized to pay 75 per The tederal government is authorized to pay 75 per cent of the cost of authorized state projects for fish and wildlife restoration. Aid funds granted under the Federal Aid Acts must be used to implement only approved projects. The program is administered by the Department of the Interior, whose regulations provide for: (1) apportionment and certification of available funds; (2) notice of desire to participate in the program; (3) period of desire to participate in the program, (5) periods from fund availability; (4) diversion of funds from authorized projects; (5) information to be furnished the Department concerning state wildlife laws and the number of holders of hunting and fishlaws and the infinite of the control statement; (10) financial plans; (11) plans, specifi-cations and estimates; (12) project agreements; (13) officials not to benefit from federal aid; (14) equal employment opportunity; (15) submission of documents; (16) divergence of opinions over project merits; (17) contracts; (18) safety; (19) production of income; (20) civil rights; (21) inspection; (22) payments of federal aid; (23) vouchers; (24) records and reporting; (25) use of convict labor; (26) avoidance of water pollution; (27) patents; and (28) fish and wildlife planning. In the performance of approved projects states must take necessary action to avoid water pollution as a direct or indirect result of project activity. (Hart-Florida) W71-09197

## WATER AND ENVIRONMENTAL QUALITY

IMPROVEMENT ACT OF 1970.
Public Law No 91-224, 84 Stat 91, 4 US Code Cong and Admin News, p 539-570 (1970). 32 p.

Descriptors: \*Water pollution, \*Environment, \*Water quality, \*Administrative agencies, Water pollution control, Oil, Oil industry, Oil fields, Pollutants, Pollution abatement, Water pollution sources, Water pollution effects, Sewage, Sewage disposal, Ships, Acid mine water, Mine water, Mine water, Mine water, Mine water, Sewage of Sewage disposal, Ships, Acid mine water, Mine wastes, Alaska, Grants, Government finance, Federal government, Lakes.

The first of two parts of the Water and Environmental Quality Improvement Act of 1970 is wholly concerned with water quality improvement. The topic initially covered in the water quality section is control of pollution by oil. Strict liability for oil pollution is the impetus of the section. Further water quality topics are: (1) control of hazardous polluting substances; (2) control of sewage from vessels; (3) area acid and other mine water pollution control demonstrations; (4) pollution control in the Great Lakes; (5) training grants and contracts; (6) applications for training grants or contracts; allocation of grants or contracts; (7) award of scholar-ships; (8) definitions and authorizations; (9) Alaska village demonstration projects; and (10) cooperation by all federal agencies in the control of pollution. The second part of the Act is devoted to environmental quality; after first stating the findings, declarations, and purposes of Congress in enactment, regulations are promulgated governing: (1) the Office of Environmental Quality; (2) environmental quality reports; and (3) authorized expenditures. (Hart-Florida) W71-09198

# LAW AND TAXATION--A GUIDE FOR CON-SERVATION AND OTHER NONPROFIT OR-GANIZATIONS.

Conservation Foundation, Washington, D. C.

The Conservation Foundation, Wash, DC, June 1970, 47 p, 7 ref.

Descriptors: \*Taxes, \*Conservation, \*Environment, \*Legal aspects, Legislation, Ecology, Financing.

Important considerations for any group created for the purpose of conservation or environmental improvement are the tax implications of the organizational form. This article attempts to provide a guide in these areas. The article begins with a discussion of the advantages and disadvantages of the corporate form with respect to taxation. Public foundations are defined. The emphasis is placed upon the tax situation of corporations, and particularly on the ways of securing and maintaining tax exempt status. Also included is a section devoted to the considerations of private foundations. (Duss-Florida) W71-09199

WATER QUALITY ACT OF 1965 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO ESTABLISH THE CONTROL ACT TO ESTABLISH THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION.

Senate Bill 4, 89th Cong, 1st Sess (1965). 11 p.

Descriptors: \*Water Quality Act, \*Water pollution control, \*Pollution abatement, \*Standards, Water pollution, Water quality control, Sewage disposal, Sewage treatment, Water resources development, Sewage treatment, water resources development, Administration, Administrative agencies, Regulation, Water pollution treatment, Treatment facilities, Water allocation (Policy), Water conservation, Legislation, State governments, Municipal wastes, Industrial wastes, Cities, Local government, Grants, Research and development, Legal aspects.

In order to enhance the quality of water resources and establish a national policy for water pollution abatement, the Federal Water Pollution Control Act would be amended by this legislation to establish the Federal Water Pollution Control Administration. Grants would be authorized to states, municipalities and appropriate agencies for research and development of improved methods of sewage discharge, subject to various limitations. Provisions relating to appropriations would also be amended. Grants would be increased for construction of municipal sewage treatment works as part of comprehensive water quality plans. After consulta-tion with the applicable federal or state agencies, the Secretary of Health, Education and Welfare would be authorized to prepare regulations setting forth water quality standards for interstate waters. In establishing such standards, the Secretary could take into consideration public water supply needs, propagation of fish and wildlife, recreational purposes, and other uses of the waters. Before the standards would be promulgated, states and interstate agencies would be given an opportunity to develop their own standards in accordance with the purposes of the Act. Discharge in derogation of water quality standards would be subject to abatement. (Smiljanich-Florida) W71-09200

## AN ACT FOR A COMPREHENSIVE WATER AND RELATED LAND RESOURCES MANAGEMENT PROGRAM (THE ARKANSAS WATER PLAN).

Act 217, Acts of Arkansas, p 682-693 (1969). 12

Descriptors: \*Arkansas, \*Water resources development, \*Administration, \*Planning, Water resources, Land resources, Water management (Applied), Water policy, Project planning, Project purposes, Water allocation (Policy), Water supply, Water utilization, Financing, Government finance, Debt, Income, Institutions, State jurisdiction, State governments, Local governments, Administrative agencies, Legislation, Legal aspects.

The Arkansas Soil and Water Conservation Commission is directed by this Act to prepare, develop and engate the Arkansas Water Plan, a comprehensive program for the orderly development and management of the state's water and related land resources. The Commission is authorized to engage in any water development project that is to be included in the Plan. In using appropriated funds the Commission may provide the cost of planning, acquisition, construction and maintenance of the water development projects. The Commission is authorized to establish the Arkansas Water Development Fund, which shall be used to pay for the water development projects. Among the powers and duties of the Commission are the responsibility for the proper distribution and allo-cation of state water and for other necessary administrative functions. Provision is made for the creation and issuance by the Commission of

## Group 6E—Water Law and Institutions

revenue bonds to secure the payment of the project costs, subject to various limitations. Penalties for violation of the Act are set forth. (Smiljanich-Florida) W71-09201

STATE CORPORATE INCOME TAX DEDUCTIONS FOR AMOUNTS INVESTED IN ANTI-DEVICES, SYSTEMS FACILITIES.

Act No 1136, Acts of Alabama, p 2115-2122 (1969). 8 p.

Descriptors: \*Alabama, \*Taxes, \*Pollution abatement, \*Income, Treatment facilities, Water pollution, Air pollution, Water pollution control, Water pollution treatment, Government finance, Tax rate, State governments, Net income, Costs, Return (Monetary), Amortization, Legislation, Legal aspects, Industries. Identifiers: \*Tax deductions.

A prior act providing for certain state corporate income tax deductions is hereby amended to include deductions for anti-pollution devices. All amounts invested in devices, systems or facilities used or placed in operation in the state primarily for the protection of the public interest through the abatement of air and water pollution shall be allowable as deductions in computing the state corporate income tax. In lieu of such deduction the amounts invested may be amortized. Any deductions taken under this Act shall exclude all other allowable deductions for such investment. (Smiljanich-Florida) W71-09202

AN ACT PROVIDING FOR TAXATION DEDUCTION OF COST OF POLLUTION ABATEMENT

Act No 1140, Acts of Alabama, p 2131-2134

Descriptors: \*Alabama, \*Pollution abatement, \*Taxes, \*Assessments, Treatment facilities, Evaluation, Water pollution control, Water pollution, Air pollution, Water pollution treatment, Water quality control, Government finance, Tax rate, Property values, Legislation, Legal aspects, Non-structural alternatives.

An existing act providing for the taxation of corporations is by this act amended to include certain deductions. A corporation may deduct from the assessed value of its shares the assessed value of all devices, systems and facilities constructed, used or placed in operation in the state primarily for the protection of the public interest through the abatement of air and water pollution. Taxation shall be only on the assessed value of the remainder. (Smiljanich-Florida) W71-09203

AN ACT PROVIDING FOR THE EXEMPTION OF STATE USE TAXATION OF POLLUTION ABATEMENT DEVICES OR FACILITIES.
Act No 1141, Acts of Alabama, p 2134-2136 (1969).

Descriptors: \*Alabama, \*Pollution abatement, \*Taxes, \*Treatment facilities, Water pollution control, Water pollution treatment, Air pollution, Water pollution, Water quality control, Government finance, Tax rate, Industrial plants, Legislation, Legal aspects.

An existing act providing for the exemption from the state use tax of certain property and proceeds is hereby amended to include pollution abatement devices. The storage, use or consumption of any devices, systems, facilities, or materials used or placed in operation within the state primarily for the protection of the public interest through the abatement of air and water pollution shall be exempt from state use taxation. (Smiljanich-Florida) W71-09204

IMPROVEMENT **ENVIRONMENTAL** AUTHORITIES ACT OF 1969. Act No 1117, Acts of Alabama, p 2060-2072

(1969). 13 p.

Descriptors: \*Alabama, \*Pollution abatement, \*Institutions, \*Water pollution, State governments, Administrative agencies, Water resources development, Administration, Management, Surveys, Planning, Water management (Applied), Water pollution treatment, Water quality control, Air pollution, Environmental sanitation, Local governments, Environment, State jurisdiction, Environmental effects, Taxes, Debt, Treatment facilities, Legislation, Legal aspects.

Authorization is hereby given for the creation of public corporations as authorities for the study, control, abatement and prevention of water, air or general environmental pollution. Such authorities may: (1) undertake engineering, technical, financial, legal, and other studies and surveys with respect to water and other environmental pollution problems and hazards; (2) construct, acquire, operate and control equipment, facilities and systems for the abatement of water and other environmental pollution problems; and (3) cooperate with and lend financial assistance to municipalities, counties and industries in matters and undertakings, the end purposes of which are pollution abatement. Procedures for incorporation are set forth, along with the composition of such corporations and certain tort immunities and tax exemptions. The authorities shall have normal corporate powers and may issue bonds secured by statutory mortgage liens to finance their operations. The public corporations shall cooperate with political subdivisions and other agencies and instrumentalities of the state whenever necessary. (Smiljanich-Florida) W71-09205

AN ACT PROVIDING FOR THE INCORPORA-TION OF PUBLIC WATER, SEWER AND FIRE PROTECTION DISTRICTS.

Act No 29, Acts of Alabama, p 2630-2652 (1970).

Descriptors: \*Alabama, \*Water districts, \*Public utility districts, \*Sewage districts, Local governments, State governments, Water works, Water distribution (Applied), Water rates, Water supply, Sewage disposal, Municipal wastes, Sewage treatment, Treatment facilities, Eminent domain, Boundaries (Property), Debt, Loans, Investment, Government finance, Taxes, Legislation, Legal

Upon application to and authorization by a county or municipality, water, sewer and fire protection districts may be incorporated as public corporations for the provision of applicable services. Such districts are authorized to acquire, construct. operate, improve and finance water works plants, water distribution systems, sanitary sewer systems and fire protection facilities. The power of eminent domain is conferred on the districts. Provisions are set forth for the procedures of incorporation, the boundaries of the districts, their governance and other necessary powers. Procedures relating to the establishment, revision and collection of charges for the district services are included. Authorization is given for the financing of corporate purposes through interest bearing revenue bonds and other securities payable out of the revenues of the systems or facilities and secured by statutory mortgage liens. The districts may distribute and sell water, furnish and provide sewer and fire protection services, or perform such services in any combination. The districts shall be exempt from taxation and shall have certain tort liability immunities. Provisions for the dissolution of the districts and disposition of their property are also included. (Smiljanich-Florida) W71-09206

CERTIFICATION OF WATER AND WASTE WATER TREATMENT PLANT OPERATIONS

General Act No 210, Georgia Laws, p 272-278 (1969). 7 p.

Descriptors: \*Georgia, \*Treatment facilities, \*Operation and maintenance, \*Management, Waste water treatment, Waste water disposal, Waste water (Pollution), Pollution abatement, Water pollution treatment, Water treatment, Water pollution, Employment, Engineering personnel, Occupations, Working conditions, Personnel, Leadership, Permits, Administrative agencies, Administra judication procedure, Administration, Legislation,

In order to protect the public health and welfare and to conserve and protect the water resources of the state, this Act hereby requires the certification and examination of all water and waste water treatment plant operators. The State Board of Examiners for Certified Water and Waste water Treatment Plant Operators is created. The Board shall classify all public water supply systems and waste water treatment plants as to size, type, character of water to be treated, and other physical conditions indicating the skill, knowledge and experience that the operator must have to successfully operate each type of plant and prevent unlawful pollution. Provisions for application, examination and issuance of certificates to operators are included, and penalties for violations of the Act are prescribed. The Board may revoke the certificate of an operator, after a hearing, when it is found that the operator has practiced fraud or deception, that reasonable care was not used in the performance of his duties, or that the operator is incompetent or unable to properly perform his duties. Judicial review is provided for such revocations. (Smiljanich-Florida) W71-09207

GUIDELINES FOR AGENCY STATEMENTS ON PROPOSED FEDERAL ACTIONS AFFECTING THE ENVIRONMENT.

Council on Environmental Quality, Wash, D.C.

Federal Register, Vol 36, No 79, p 7724-7729 (April 1971), 6 p.

Descriptors: \*Administrative agencies, \*Adoption of practices, \*Environmental effects, \*Federal project policy, Legislation, Administration, Regulation, Ecology, Environment, Federal government, Clean Air Act, Federal jurisdiction, Water quality control, Pollution abatement, Water resources, Natural resources, Water resources development, Water pollution, Air pollution, State governments, Local governments, Legal aspects.
Identifiers: \*National Environmental Policy Act.

The Council on Environmental Quality herein provides guidelines to federal departments, agencies and establishments for preparing detailed environ-mental statements on proposals for legislation and other major federal actions significantly affecting the quality of the human environment as required by the National Environmental Policy Act. The objective of the guidelines is to build into the agency decisionmaking process an appropriate and careful consideration of the environmental aspects of proposed action, including proposed water quality standards, and to assist agencies in implementing the EPA. Prior to agency decision concerning major actions or recommendations that significantly affect the environment, federal agencies will, in consultation with other appropriate federal, state and local agencies, assess in detail the potential environmental impact. Agency procedures are provided for: the types of actions which will require such reports, state and local review of the environmental impact, and the content of the environmen-tal statements. Guidance for implementation of the Clean Air Act is also provided. Appended hereto are forms which should accompany each environ-mental statement and a list of federal agencies with jurisdiction by law or special expertise to comment

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on various types of environmental impacts. (Smiljanich-Florida) W71-09208

#### ANIMAL SLAUGHTERING AND PROCESSING.

National Industrial Pollution Control Council, Sub-Council Report (Feb 1971). 14 p.

Descriptors: \*Animals, \*Pollution abatement, \*Administrative agencies, \*Industries, Industrial water, Industrial water, Mater pollution sources, Waste water treatment, Waste treatment, Water pollution, Pollutants, Water pollution control, Research and development, Water quality, Water quality control.

The significant environmental problems which face the meat packing, poultry, rendering, and cattle feeding and holding industries are identified in this It also describes specific research and development activities currently being conducted and discusses economic and institutional ramifications of pollution control upon the industries concerned. The programs under way involve large expenditures for pollution control equipment, extensive research and testing, and close cooperation with local, state, and federal government agencies responsible for pollution control. Eutrophication and odor control studies indicate that sampling, laboratory methodology, and data collection techniques are essential to gaining knowledge for effective research. Additionally, two areas capable of significant impact upon reduction of treatable wastes are: (1) water use reduction of treatable wastes are: (1) water use reduction studies and control programs, and (2) in-plant control programs to reduce quantities of pollutants. (Hart-Florida) W71-09209

#### REGIONALLY CONSOLIDATED INDUSTRIAL WASTE WATER TREATMENT.

National Industrial Pollution Control Council, Sub-Council Report (Feb 1971). 34 p, 4 fig, 1 tab.

Descriptors: \*Waste treatment, \*Industrial wastes, \*Waste water (Pollution), \*Waste water treatment. Municipal wastes, Research and development, Regions, Industrial water, Industries, Water pollution, Water pollution control, Water quality, Water quality control, Wastes, Systems analysis, Estimating, Management.

The substandard water quality of the nation's streams, lakes and estuaries presents a large demand for waste water treatment facilities. Regional consolidation of wastes and treatment in fewer and larger facilities is an advantageous method of meeting this demand. Although some public assistance may be expected, industry should examine available alternatives for treating its wastes to minimize costs. To date, limited success has been achieved in serious attempts at regional consolidation. Therefore, more effective methods of planning and implementing the required facilities are necessary. To evaluate technical feasibility, waste streams should be catagorized as to treatment processes and environmental effects. The economic cost of feasible disposal modes should be determined and evaluated for environmental impact. Two approaches exist for advancing understanding of regional water quality control systems: (1) systems planning studies, and (2) technology studies. Since technology dies, and (2) technology studies. Since technology studies ignore systems interaction, the systems planning approach should be given priority. Once feasibility is shown, systems planning studies would follow. Technology studies should also be utilized in narrowly-defined areas. (Hart-Florida) W71-09210

## CITY OF FRANKFORT V SLIPHER (MU-NICIPAL SEWAGE DISPOSAL). 162 NE 241-247 (App Ct Ind 1928).

Descriptors: \*Indiana, \*Municipal wastes, \*Sewage disposal, \*Treatment facilities, Riparian rights,

Public health, Natural streams, Treatment, Pollutants, Sewers, Sewage effluents, Judicial decisions, Damages, Wastes, Waste treatment, Waste disposal, Legal aspects.

Plaintiff riparian owner sued defendant city for damages resulting from defendant's upstream discharge of untreated sewage into a natural stream discharge of untreated sewage into a natural stream bordering plaintiff's farm. On appeal from a judgment for plaintiff, defendant contended that: (1) a municipality may lawfully discharge un-treated sewage into a stream which is a natural outlet, providing the discharge is not negligent, and (2) it's actions did not constitute a public nuisance. In affirming, the Appellate Court of Indiana held that defendant was negligent in failing to utilize available technology to construct a sewage treatment facility. The court reasoned that, although defendant was authorized by statute to build and maintain sewers, public necessity did not require the discharge of untreated sewage which could have been purified at a reasonable cost. (Madsen-Florida) W71-09218

#### MITCHELL REALTY CO V CITY OF WEST ALLIS (EXTENT OF DAMAGES CAUSED BY CITY'S POLLUTION OF STREAM). 206 NW 193-195 (Wis 1925).

Descriptors: \*Wisconsin, \*Water pollution, \*Water pollution sources, \*Damages, Streams, Sewage, Overflow, Land, Land tenure, Effluents, Sewage effluents, Sewers, Outlets, Industrial wastes, Judicial decisions, Legal aspects, Cities, Adjudication procedure.

Plaintiff landowner sought to recover damages for injury to his property caused by defendant city's pollution of a stream which overflowed plaintiff's land and decreased its agricultural value. Originally, plaintiff had brought suit against defendant and a private corporation which also contributed to the pollution. Plaintiff had received judgment but the Supreme Court of Wisconsin reversed on grounds not relevant to the present appeal. At the second trial damages were computed principally by referring to the testimony given in the first trial. Defendant appealed, contending that the trial court had failed to require plaintiff to establish within a reasonable certainty the damage caused by defendant and that a new determination was required as to the extent of damage caused by defendant. The Supreme Court of Wisconsin affirmed, holding that the evidence at the prior trial was sufficient to show the proportion of damage caused by defendant city. (Duss-Florida) W71-09231

# WAGNER V TOWN OF CONOVER (CITY'S LIABILITY FOR DISCHARGE OF SEWAGE INTO STREAM). 156 SE 167-169 (NC 1930).

Descriptors: \*North Carolina, \*Cities, \*Water pollution, \*Sewage, Water pollution effects, Water pollution control, Water pollution sources, Sewerage, Pollutants, Water law, Discharge (Water), Adjudication procedure, Judicial decisions, Legal aspects, Springs, Swimming pools, Streams, Riparian rights.

Plaintiff landowner sued defendant municipality for damages resulting from the discharge of city sewage into a stream which ultimately flowed through plaintiff's land. Plaintiff showed that a spring in the stream bank disappeared after defendant began discharging sewage, and that the stream water was used for a swimming pool. This evidence was held competant. Defendant asserted that the lower court's charge to the jury with respect to injury to health from maintainance of sewerage flow was prejudicial. The North Carolina Supreme Court held that, since no evidence or contention of injury to health was presented, the charge did not harm defendant. Defendant further contended that the lower court's charge that, if permanent damages were awarded, defendant would have an easement to continue discharge was reversible crror. Nevertheless, the lower court's charge was upheld. The court observed that plaintiff had a right to have the issue of permanent damages presented to the jury. The lower court's decision for plaintiff was affirmed. (Hart-Florida)

## CITY OF BARNESVILLE V PARHAM (CITY'S LIABILITY FOR DISCHARGING SEWAGE INTO OPEN STREAM). 160 SE 879-880 (Ga Ct App 1931).

Descriptors: \*Georgia, \*Cities, \*Sewage, \*Damages, Rent, Streams, Water pollution, Odor, Water pollution effects, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff dairy farmer sued defendant city for damages from the discharge of sewage into a stream running through plaintiff's land. The sewage caused obnoxious odors on plaintiff's land. Plaintiff sought damages for the impaired rental value of his land. The Georgia Court of Appeals stated that plantiff might recover damages for the impaired rental value, and that the measure of damages was the diminution in rental value attributable to the injury. Furthermore, plaintiff's allegations that he lost profits from his dairy operation were upheld as equivalent to rental value for determining damages. However, the lower court's failure to instruct the jury on the proper measure of damages was held reversible error. (Hart-Florida) W71-09244

# SANITARY DIST OF CHICAGO V CHICAG PACKING CO (DISCHARGE OF STOCKYARD WASTE INTO SEWAGE CHANNEL). 241 III App 288-314 (1926).

Descriptors: \*Illinois, \*Sewage, \*Channels, \*Waste disposal, Cities, Administrative agencies, Waste treatment, Sewage treatment, Lake Michigan, Rivers, Water pollution control, Waste dilution, Waste assimilative capacity, Solid wastes, Municipal wastes, Legal aspects, Judicial decisions, Legislation.

Plaintiff sanitary district sought to enjoin defendant packing company from discharging trade wastes into plaintiff's sanitary channel. Plaintiff was organized to construct a channel to divert Chicago's municipal sewage into the Des Plaines River, away from Chicago's Lake Michigan water supply. Plaintiff contended the legislation did not contemplate discharge of solid trade wastes into the channel along with sewage and that defendant's trade wastes were not diluted or oxidized by the water, therefore creating a malodorous nuisance. Defendant contended that plaintiff was required by the applicable legislation to accept their trade wastes. The Illinois Appellate Court found that the legislation stated that before sewage was discharged, all garbage, dead animals, and parts thereof should be taken therefrom. Accordingly, it held that defendants could not discharge their wastes into the channel. Defendant's contention that plaintiff had no jurisdiction over Chicago's sewers and could not object that defendant discharged trade wastes into them was rejected. (Hart-Florida) W71-09245

## AN ANALYSIS OF ALTERNATIVE INSTITU-TIONAL ARRANGEMENTS FOR IMPLEMENT-ING AN INTEGRATED WATER SUPPLY AND WASTE MANAGEMENT PROGRAM IN THE WASHINGTON METROPOLITAN AREA, Institute for Defense Analyses, Arlington, Va. In-

ternational and Social Studies Div.

Paul S. Hughes.

Available from the National Technical Information Service as PB-198 012, \$3.00 in paper copy, \$0.95 in microfiche. Institute for Defense Analyses Paper P-714, Mar 1971. 103 p.

## Field 06—WATER RESOURCES PLANNING

## Group 6E—Water Law and Institutions

Descriptors: \*Water supply, \*Waste treatment, \*Institutional constraints, \*Urban sociology, Waste disposal, Waste water disposal, Water reuse, Mathematical models, Sewage treatment, Solid wastes, Maryland, District of Columbia. Identifiers: Water reclamation, Management engineering, Maryland, \*Solid waste management, Washington metropolitan area, Potomac River basin.

The purpose of this paper is to consider what type of institutional machanism would be most ap-propriate for implementing an integrated water propriate for implementing an integrated water supply and waste management program in the Washington metropolitan area. Such a program is defined as one which contains comprehensive planning responsibilities cutting across many services, but which provides wholesale operating capability in the areas of water supply, waste water treatment, and solid waste management.

W71-09260

## C N O AND T P RY CO V MOON (DUTY OF RAILROAD TO MAINTAIN DRAINAGE DITCH).

2 Tenn App 477-482 (1926).

Descriptors: \*Tennessee, \*Railroads, \*Ditches, \*Surface drainage, Right-of-way, Easements, Surface runoff, Drainage water, Overland flow, Rain water, Culverts, Drains, Drainage effects, Boundaries (Property), Prescriptive rights, Natural flow doctrine, Obstruction to flow, Judicial decisions, Legal aspects.

Plaintiff landowner sued defendant railroad for damages caused by the overflow of a drainage ditch the railroad right-of-way. Plaintiff contended that the railroad had negligently allowed the ditch to become filled up, thus causing drainage water to back up and damage plaintiff's land. Defendant contended that, due to maintenance of the drainage ditch for more than twenty years, it had acquired rights by prescription. Defendant also contended that plaintiff had title to the drainage contended that plantiff had title to the drainage ditch and the duty to keep it open. In affirming a verdict and judgment for plaintiff, the Tennessee Appeals Court, Eastern Section, noted that the ditch along the right-of-way had been dug by the defendant for the purpose of providing and protecting the natural drainage of plaintiff's land. It is the duty of a railroad to provide ditches for the natural drainage of land along its right-of-way. Plaintiff therefore had no duty to go onto the right-of-way and clear the ditch. The railroad, in previously keeping the ditch open, thereby recognized plaintiff's right to have his surface drainage free from obstruction, and could claim no rights by prescription. (Smiljanich-Florida) W71-09263

### SCHLESSINGER V ROSENHEIM (LIABILITY OF TENANT FOR DRAINAGE OF RAIN WATER FROM ROOF ONTO NEIGHBORING BUILDING).

2 Tenn App 529-535 (1926).

Descriptors: \*Tennessee, \*Roofs, \*Rain water, \*Drainage, Drainage effects, Surface drainage, Repulsion (Legal aspects), Land tenure, Drainage water, Remedies, Damages, Leases, Buildings, Rainfall, Runoff, Drainage practices, Judicial decisions, Legal aspects.

Plaintiff store owner sued defendants, a landlord and a tenant, for an injunction and for damages caused by water being dumped onto plaintiff's roof from an adjoining building. Plaintiff contended that rainwater was drained from defendant's roof by a downspout onto plaintiff's roof, thereby damaging his store. Defendant landlord contended that the tenant was solely responsible for any damage. Defendant tenant contended that he had not constructed the spout and was under no duty to remove it, and that the water from his roof had wrongfully been drained onto his building from another building. In affirming a lower court judgment for plaintiff, the Tennessee Appeals Court, Eastern Section, noted that the tenant, not the landlord, was under a duty to keep the building in repair. Upon being notified it became the tenant's duty to remove the downspout, which was under his control and which he had no legal right to maintain. The fact that the water was being diverted onto the tenant's roof by another did not justify his diversion of the water onto plaintiff's roof. (Smiljanich-Florida) W71-09267

## SUMNER V O'DELL (INJUNCTION TO PREVENT POLLUTION OF SPRING WATER BY CATTLE). 12 Tenn App 496-500 (1930).

Descriptors: \*Tennessee, \*Water pollution, \*Streams, \*Reasonable use, Cattle, Domestic water, Riparian rights, Water quality, Spring waters, Springs, Legal aspects, Judicial decisions, Water pollution sources, Remedies, Relative rights.

Plaintiff lower riparian landowner sought to enjoin defendant upper riparian landowner from polluting the stream bordering their property. Plaintiff's and defendant's tracts were previously owned by one person, who conveyed plaintiff's tract first, along with the right to use the spring water flowing from defendant's tract. When defendant purchased the upper tract, he began using the lot through which the stream flowed as a confinement for cattle. The cattle polluted the water so that it was unfit for plaintiff's domestic uses. Apparently defendant's actions were purposeful, and with some malice, since the evidence presented clearly showed that defendant could have erected his fences to prevent pollution of the spring water. The Tennessee Court of Appeals held that defendant was utilizing his property unreasonably with respect to plaintiff's rights, and enjoined use of the lot as a cow pasture and path. (Hart-Florida) W71-09333

## LEGAL ASPECTS OF WATER USE AND CON-TROL IN SOUTH CAROLINA. PART A -LEGAL CONSIDERATIONS RELATING TO A NEW WATER RESOURCES LAW FOR SOUTH CAROLINA.

Clemson Univ., S.C. Water Resources Research

Available from the National Technical Information Service as PB-200 654, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Research Institute, Clemson University, Clemson, SC, Report No 20, Mar 1971. 68 p. OWRR Project B-003-SC (2).

Descriptors: \*South Carolina, \*Water resources, \*Environmental effects, \*Water policy, \*Permits, Legal aspects, Legislation, Administrative agencies, Regulation, Water pollution, Judicial decisions, Rivers and Harbors Act, Land use, State governments, Coordination, Riparian rights.

Increasing and competing demands for water use have persuaded legislatures in many riparian states to enact statutes modifying traditional riparian rules. Some of these statutes incorporate elements of the appropriation system, and delegate to administrative agencies power to grant permits for water use. Other delegate to agencies power to declare emergency water areas, and to regulate withdrawals from such areas. Within recent years, increased concern for protection of the environment has led to statutes both Federal and State providing for inventory of water and related resources, large scale planning for water use and control, including water zoning, and extensive reorganization of administrative agencies to deal with these problems. South Carolina is experiencing population growth and industrial development, and is beginning to face some of the problems these statutes were designed to meet. These statutory developments are examined, with a view to their consideration by the administrative agencies and

the General Assembly of South Carolina. Problems of State constitutional law relating to water use and control are also examined. (See also W71-09364)

LEGAL ASPECTS OF WATER USE AND CONTROL IN SOUTH CAROLINA. PART B - SOUTH CAROLINA LAKES AND PONDS: A STUDY OF PUBLIC AND PRIVATE RIGHTS THEREIN,
Clemson Univ., S.C. Water Resources Research

Inst.

David H. Means.

Available from the National Technical Information Service as PB-200 655, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Research Institute, Clemson University, Clemson, SC, Report No 21, Mar 1971. 45 p, append. OWRR Project B-003-SC

Descriptors: \*Lakes, \*Legal aspects, \*Vanigable waters, \*Riparian rights, \*Water law, Nonnavigable waters, Ownership of beds, Public rights, Recreation, Reservoirs, Water pollution.

The growing importance of South Carolina's lakes for commercial and recreational uses necessitates increased emphasis on a water resources policy. Accordingly, the law of lakes was surveyed insofar as such law may be applicable to the formulation of an overall regulatory scheme. In general the law classifies water as navigable or nonnavigable. In navigable waters the interest of the federal government is paramount, followed by that of the state, with the public interest prevailing over that of persons with private interests resulting from the ownership of land adjacent to the water. Where the water in question is nonnavigable the public as such has no interest therein, and the exclusive right to the enjoyment of such water, subject to the police power of the state, is in the riparian landowners, that is, those persons who own a portion of the bed of the nonnavigable water. In the regulation of competing interests in the use of water, the legal tools available include those of eminent domain and of statutes; the riparian system; and the use of restrictive covenants. (See also W71-09363) W71-09364

# SHELTON V MOSIER (PRESCRIPTIVE RIGHT OF MILL DAM OWNER TO OVERFLOW UPPER STREAM).

19 Ohio App 89-94 (1924).

Descriptors: \*Ohio, \*Mill dams, \*Overflow, \*Prescriptive rights, Dams, Floods, Backwater, Streams, Riparian land, Land tenure, Easements, Riparian rights, Competing uses, Obstruction to flow, Reasonable use, Natural flow doctrine, Relative rights, Riparian waters, Submergence, Judicial decisions, Legal aspects.

Plaintiff upper landowner sued defendant lower landowner for damages resulting from the overflow of a stream caused by defendant's mill dam. Plaintiff contended that water backed up by the dam damaged his crops and land. Defendant contended that the dam had been maintained in the same condition and height for more than twenty-one years and that defendant had therefore obtained a prescriptive right to dam the stream and cause its overflow. In reversing a lower court verdict and judgment for defendant, the Court of Appeals for Gallia County, Ohio, noted that defendant had not shown that the dam had been affecting the overflowed lands to the same degree for more than twenty-one years. When a right to overflow upper lands rest in prescription only, its extent is mea-sured by the actual enjoyment of the easement, and not by the height of the dam maintained during that period. As defendant had failed to allege habitual or usual overflow during the period of prescription, his defense was inadequate, and the crucial question in the case had not been tried. (Smiljanich-Florida) W71-09369

#### Water Law and Institutions—Group 6E

WELLS V SHEETS (CITY'S LIABILITY FOR LANDOWNERS POLLUTING DITCH NO PART OF THE CITY'S DRAINAGE SYSTEM). 213 Ky 438, 281 SW 159-162 (Ct App Ky 1926).

Descriptors: \*Kentucky, \*Water pollution, \*Cities, \*Drainage, Water pollution sources, Water pollution effects, Water quality, Ditches, Damages Legal aspects, Sewers, Drainage systems, Judicial decisions.

Plaintiff landowner sued defendant city and defendant landowners to recover damages for pollution of a natural drainage ditch flowing through plaintiff's lot. The ditch flowed along the rear of defendant landowners' lots, and they discharged their sewage, garbage, and other refuse into it. The polluted water lay stagnant in the ditch on plaintiff's lot, and created offensive odors and a breeding place for mosquitoes. At trial, the complaint against defendant city was dismissed. On appeal, the remaining defendants contended that the city was jointly liable. The complaint contended that the landowners used the drain with the city's permission. The Court of Appeals of Kentucky held that the city could not be liable unless the drain were part of its sewage system, and noted that the city could not give permission to use the ditch unless it were part of the sewage system. Since the city had not formally adopted the ditch as part of its sewer system, the court upheld the lower court's dismissal. Furthermore, the court held that the evidence supported the lower court's denial of defendant landowners notion for a directed verdict. (Hart-Florida) W71-09371

FISH-TOXICITY PROBLEMS OF PESTICIDES IN JAPAN - THE PRESENT SITUATION AND THE POLICIES OF THE MINISTRY OF AGRICULTURE AND FORESTRY, Agricultural Chemical Inspection Station, Tokyo

(Japan).

For primary bibliographic entry see Field 05A. W71-09377

#### BEAVER DAM COAL CO V DANIEL (POLLU-TION DAMAGE TO AGRICULTURAL LAND).

227 Ky 423, 13 SW2d 254-257 (1929).

Descriptors: \*Kentucky, \*Riparian rights, \*Mine wastes, \*Water pollution effects, Legal aspects, Judicial decisions, Remedies, Damages, Pollutants, Mining, Mine drainage, Coal mines, Industrial wastes, Water pollution sources, Path of pollutants, Flood damage, Impaired water quality, Riparian waters, Waste disposal, Pollutant identification.

Plaintiff riparian owner obtained judgment against defendant coal mining company for damages to plaintiff's land. Plaintiff alleged that a watercourse draining his land was polluted upstream by copperas and copperas water escaping from defendant's mine, and that when the watercourse overflowed, copperas was deposited on plaintiff's land, decreasing its fertility. On appeal, defendant contended: (1) that it was absolved by an 'act of God', an unprecedented rain which caused the flood; (2) that plaintiff could not recover because there was no negligence shown on defendant's part; and (3) that defendant was liable only for one third of the damage to plaintiff's land, since the evidence showed that two thirds of the copperas water came from mines other than defendant's. The Court of Appeals of Kentucky held that an 'act of God' would be a defense only if it were the proximate and sole cause of the injury, and that it would assume that the jury assessed only the proportion of damages shown by the evidence to have been caused by defendant's mine. The court also held that plaintiff, as a riparian owner, need not show negligence, but only invasion of his rights by defendant. (Madsen-Florida) W71-09380

CONESTEE MILLS V CITY OF GREENVILLE (CITY'S LIABILITY TO LOWER RIPARIAN OWNER FOR SEWAGE DISCHARGE). 158 SE 113-120 (SC 1931).

Descriptors: \*South Carolina, \*Water pollution, \*Cities, \*Sewage, Water pollution effects, Water pollution control, Water pollution sources, Pollution abatement, Pollutants, Odor, Legal aspects, Judicial decisions, Prescriptive rights, Rivers, Riparian rights, Discharge (Water).

Plaintiff lower riparian owner sued defendant city to recover damage from water pollution. Defendant was discharging sewage into the river adjacent to plaintiff's property in 1892, pursuant to legislation. The discharges resulted in fishkill, offensive odors, and contamination. Twenty years had elapsed before plaintiff sued, and defendant asserted a prescriptive right to continue the discharges. The pollution was characterized as a continuing nuisance, however, and no actionable injury had arisen previously; hence the South Carolina Supreme Court held that defendant had not acquired a prescriptive right to pollute. Defendant furthermore asserted that plaintiff purchased subject to the pollution. Since the pollution could be abated, the discharges were not characterized as an inverse condemnation and the court rejected the contention. The court also held that the statute of limitations did not bar actions for injuries occuring in the six years prior to suit. Accordingly, the lower court's decision in favor of defendant was reversed. (Hart-Florida) W71-09383

## **BUCKLES V CITY OF DECATUR (LIABILITY** OF CITY FOR POLLUTION OF RIVER). 234 Ill App 89-97 (1924).

Pescriptors: \*Illinois, \*Water pollution, \*Livestock, \*Stock water, Water pollution effects, Water pollution sources, Cities, Sewage, Water quality, Potable water, Diseases, Mortality, Riparian rights, Natural flow doctrine, Pollutants, Waste disposal, Color, Odor, Fishkill, Toxicity, Taste, Farms, Judicial decisions, Legal aspects.

Plaintiff riparian landowner sued defendant municipality to recover damages for injury to livestock resulting from pollution of the river running along plaintiff's land. Defendant discharged its sewage into the river, and plaintiff's stock became ill, some dying, from drinking the polluted water. At trial, the jury found defendant not liable, and plaintiff appealed when his motion for a new trial was denied. The Illinois Appellate Court stated that a riparian owner has a right to the natural flow of the stream, and that one causing pollution was liable in damages. The court furthermore observed that a city was liable as any private person would be and that liability was unaffected by the size of the city. Following an extensive review of the evidence presented at trial, the court determined that defendant's evidence failed to refute the evidence presented by plaintiff. Accordingly, the court held that the verdict was contrary to the weight of the evidence and reversed and remanded for a new trial. (Hart-Florida) W71-09386

## POLICY AND PLANNING FOR RECREATIONAL USE OF INLAND WATERS,

Connecticut Univ., West Hartford. School of Law. Robert I. Reis.

Temple Law Quartely, Vol 40, No 2, p 155-193, Winter 1967. 82 references. OWRR Project A-012-CONN (1).

Descriptors: \*Recreation, Legal aspects, Economics, Water law.
Identifiers: \*Connecticut, Normanoch Association, Lewis and Clark, Ohio, Oregon, New England.

This article discusses the conflict between private ownership of lakes and public need of open waters for recreational uses. The author describes the philosophical and economic implications of judicial control over private ownership of lake facilities. He concludes that states should develop long range plans for recreational development and make plans for the acquisition of private lakes for the public. (Holmes-Rutgers) W71-09391

## CHRISTIE V SANITARY DISTRICT OF CHICAGO (LIABILITY FOR EXCESSIVE DISCHARGE OF WATER).

256 Ill App 63-110 (1930).

Descriptors: \*Illinois, \*Sewage, \*Flooding, \*Electric power production, Cities, Waste dilution, Public health, Dams, Levees, Adjudication procedure, Legal aspects, Judicial decisions, Sewage treatment, Rivers, Lake Michigan, Flood damage, Canals, Design flow, Discharge (Water),

Plaintiff riparian landowner sued defendant sanitary district for damages resulting from excessive discharge of water into the Illinois River. Defendant discharged water from Lake Michigan into a channel to dilute the sewage from Chicago, which flowed into the river. The authorized quantity of water was in direct ratio to Chicago's population. Plaintiff charged that defendant: (1) discharged more than the suthorized quantity; (2) the flowage was not continuous; and (3) discharged additional water to generate electricity. As a result, defendant's lands were flooded. The Illinois Appellate Court determined, however, that plaintiff's assertions ultimately reduced to a charge that defendant had increased the flow to an excessive amount. Defendant's activities had commenced in 1903, but plaintiff did not sue until 1923. The statute of limitations was five years. Since plaintiff was unable to show that defendant had increased the flow in the preceding five year period the court held that the lower court should have directed verdict for defendant. The court held that plaintiff's cause accrued when the increased flow reached the levels of 1904 and 1913. Furthermore, the court found that defendant did not injure plaintiff by construction of use of the channel. (Hart-Florida)

## ANDREWS V VILLAGE OF GEORGETOWN (RESPONSIBILITY OF MUNICIPAL CORPORATION TO PREVENT FLOODS CAUSED BY STREET CONSTRUCTION). 34 Ohio App 79, 170 NE 450-451 (1929).

Descriptors: \*Ohio, \*Surface drainage, \*Surface runoff, \*Road construction, Road design, Roads, Surface water, Judicial decisions, Damages, Legal aspects, Floods, Flood damage, Real property, Ci-

Plaintiff landowner sought injunctive relief and incidental damages against defendant municipal corporation for surface water damage to plaintiff's residence, located within defendant's corporate limits. Flooding of plaintiff's property undisputedly resulted from reconstruction of a street abutting plaintiff's property. Defendant contended that, since the gravamen of plaintiff's case was that the reconstructed road was too high to permit drainage of surface water, defendant was not liable because the grade was fixed, the work sone, and the cost of the reconstruction paid by the state. The Court of Appeals of Ohio held that municipal corporations were responsible, under an Ohio statute, for keeping streets within their corporate limits free from nuisance, and thus affirmed the granting of an injunction against defendant. Since it appeard to the court that repairs already made by defendant would elimate future floods of plaintiff's property, the court assessed damages only for prior losses, and not for the reduction in value of plaintiff's property subject to the hazards of flood. (Madsen-

W71-09396

## Field 06—WATER RESOURCES PLANNING

## Group 6E—Water Law and Institutions

ANGLIM V CITY OF BROCKTON (MUNICIPAL LIABILITY FOR PROPERTY DAMAGES DUE TO RIVER OVERFLOW).
179 NE 289-294 (Mass 1932).

Descriptors: \*Massachusetts, \*Cities, \*Drainage systems, \*Flood damage, Stream improvement, Non-navigable waters, Streams, Dredging, Channel improvement, Stream stabilization, Surface drainage, Drainage effects, Damages, Riparian rights, Storm runoff, Sewage, Sewage disposal, Legislation, Statutes, Legal aspects, Judicial deci-

A statute authorized defendant city to improve surface drainage by improving the flow of streams within the city limits. Defendant, acting through its highway commissioners, who were public officers, employed an independent contractor to widen, deepen, and straighten natural streams. Plaintiff deepen, and straighten natural streams. Plantill landowner sought: (1) to restrain defendant from discharging refuse and sewage into a nonnavigable stream that flowed over his property nad (2) damages resulting from a runoff of sewage beyond the stream's channel during an unusual freshet. The Supreme Judicial Court of Massachusetts denied relief, holding that: (1) in the absence of a statute defendant would not be liable for the negligence of the commissioners performing public duties; (2) defendant was not liable when public officers diverted water from streets into a stream that overflowed plaintiff's property; (3) plaintiff's exclusive remedy for injury resulting from materials deposited upon his land was that specified in the statute and not a bill in equity; and (4) as to the sewage, it was deposited as a result of unusual weather and not from defendant's negligent con-struction or use of the sewers. (Rees-Florida) W71-09397

## COMPREHENSIVE WATER RESOURCES MANAGEMENT - THE PAST AND THE FU-TURE,

Department of the Interior, Washington, D.C.

A. Gordon Everett. Water Resources Bulletin, Vol 7, No 1, p 185-188,

Descriptors: \*Water resources development, \*Institutional constraints, \*Project planning, sion making, Administration.

Identifiers: Colorado River Basin, Water Resources Planning Act of 1965, Water Resources Council, Environmental Protection Agency.

American water problems have historically been characterized by the artificial separation of water quality and water quantity, and ignoring water economics. Our water affluence has allowed us to misuse them. Many agencies are affilitated with water resources management, yet only two have significant programs dealing with both quality and quantity. The whole system is poorly organized for all agencies depend on others in accomplishing their missions. (Campbell-Rutgers) W71-09398

## TURNER V PIERSON-HOLLOWELL WALNUT CO (OWNERSHIP OF LAND TO THREAD OF STREAM).

260 III App 158-166 (1931).

Descriptors: \*Illinois, \*Boundary disputes, \*Ownership of beds, \*Non-navigable waters, Legal aspects, Judicial decisions, Boundaries (Property), Rivers, Beds under water, River beds, Beds, Fresh-water, Bodies of water, Trees, Land, Real property.

Plaintiffs and their children owned a tract of land which was bordered on one side by a non-navigable river. Plaintiffs brought an action in replevin to recover six walnut logs which were taken by defendant from a large tree that had been lying in the bed of the river. The tree had lain with its large end about three feet from the land allegedly owned by plaintiffs and with the trunk in the river. The Appellate Court of Illinois held that unless the deed clearly specified otherwise, a deed of land bordered by a river also carried with it the title of the grantor in the bed of the river to the center thread of the current and that the boundary would vary as the main channel changed. Plaintiffs' deeds did not mention what portion of the river was the boundary line. The court found that there was sufficient evidence to support the finding of the trial court that plaintiffs did own the land on which the tree was taken and were hence entitled to replevy the logs. (Johnson-Florida) W71-09399

## TENNESSEE ELECTRIC POWER CO V DOD-SON (OBSTRUCTION OF GROUNDWATER FLOW).

14 Tenn App 54-62 (1931).

Descriptors: \*Tennessee, \*Percolating waters, \*Surface-groundwater relationships, \*Underground streams, Groundwater, Fresh water, Groundwater movement, Sinks, Groundwater barriers, Springs, Legal aspects, Judicial decisions, Streams, Floods, Streamflow, Water injury, Dams, Backwater, Subsurface runoff.

A stream flowed across plaintiff's land and emptied into several sinkholes. It was not known where the subterranean passages from the sinkholes lay, but the water had been traced to four springs. Two of the springs were below the level of the pool created by defendant power company's dam, while two were above the pool level. Plaintiff sued to recover for damages to his land which occurred when the discharge of water from the sinkholes was obstructed and the stream backed up and flooded his land. Plaintiff alleged that defendant's dam had caused the obstruction by blocking the normal flow of the water which left the sinkholes. The Tennessee Court of Appeals reversed a judgment for plaintiff. The presumption is that groundwater is percolating. Proof is required to show that the water flows in a well defined stream before the groundwater will be considered to be an underground stream. If water does flow in an underwater stream, the lower owner has no right to obstruct the flow so that it floods the lands of the upper owners. The court held that plaintiff had failed to show that the water flowed in an underground stream or that defendant had caused the flooding. (Johnson-Florida) W71-09400

#### COMPREHENSIVE PLANNING IN THE SOUTHEAST, Federal Power Commission, Washington, D.C.

For primary bibliographic entry see Field 06B. W71-09418

#### STATE ORGANIZATIONS FOR WATER RESOURCES FLANNING,

Utah State Univ., Logan. Dept. of Civil Engineer-

Daniel H. Hoggan.

Journal American Water Works Association, Vol 60, No 7, p 667-674, July 1968. 1 ref.

Descriptors: \*Water resources development, \*Planning, State governments. Identifiers: US Water Resource Council, California

Water Commission, New York Water Resources Commission, Minnesota, New York, Texas, Utah.

Most of the states in the United States have fine planning units but lack the management of the implementation of planning, the staffs tend to become understaffed and under funded. Thus, the integration of the various plans is hampered or lost. The piece shows two separate alternative solutions, a single state resources agency or a central group of heads of agencies for coordination. (Campbell-Rutgers) W71-09425

#### WATER RIGHTS PROBLEMS IN THE UPPER RIO GRANDE WATERSHED AND ADJOINING AREAS.

Arizona Univ., Tucson. Coll. of Law. Robert Emmet Clark.

Natural Resources Journal, Vol 11, No 1, p 48-68, Jan 1971, 97 ref.

Descriptors: \*Water law, \*Public rights, \*Water supply, \*Political aspects, Water resources development, Project planning.
Identifiers: Reclamation Law of 1902.

The author describes the history of land and water rights in Southwestern United States with primary emphasis on New Mexico. He explains that under Mexican and Spanish law water rights were not included in land grants, a fact which has led to a great deal of confusion in modern times. Also discussed are the special problems of public ownership and Indian reservation use of water supplies. (Holmes-Rutgers) W71-09426

#### PATTERNS OF POLITICS RESOURCES DEVELOPMENT, WATER

National Water Commission, Arlington, Va. Helen Ingram.

Natural Resources Journal, Vol 11, No 1, p 102-118, Jan 1971. 28 ref.

Descriptors: \*Water resources development, Costbenefit analysis, Political aspects. Identifiers: \*Central Arizona Project, Colorado River Basin Bill, Water Resources Council.

The author describes the present patterns that are used in adopting new water development projects in the United States. Even though cost-benefit analysis is used, it is easily twisted to gain support for one viewpoint, so that no overall discussion of who will benefit from the project is undertaken. A system of local pressure politics has emerged as the present pattern. (Holmes-Rutgers) W71-09427

### PHOSPHATES IN DETERGENTS AND THE **EUTROPHICATION OF AMERICA'S WATERS.** For primary bibliographic entry see Field 05C W71-09429

PHOSPHATES IN DETERGENTS AND THE EUTROPHICATION OF AMERICA'S WATERS. For primary bibliographic entry see Field 05C. W71-09430

#### CONFERENCE REPORT ON HR 4148, WATER QUALITY IMPROVEMENT ACT OF 1970.

116 Cong Rec 2464 thru 2473 (daily ed Mar 25, 1970). 9 p.

Descriptors: \*Water quality, \*Water pollution sources, \*Water pollution control, \*Pollution abatement, Governments, Federal government, Legislation, Government finance, Permits, Ad-ministration, Abatement, Water pollution, Pollutants, Oil wastes, Industrial wastes, Chemical wastes, Environmental sanitation, Water pollution treatment, Waste water (Pollution), Acid mine water, Legal aspects.

According to this excerpt from the Congressional Record favorable comments were made by several representatives concerning the Water Quality Improvement Act of 1970. The conference report was accepted by a vote of 358 yeas, 0 nays, and 72 not voting. The conference report on the Act discussed: (1) the control of oil pollution, (2) cleanup authority, (3) limits of liability for oil spilled from vessels shipping oil, (4) limits of liability for on-shore and off-shore oil installations, (5) license requirements for use of the nation's waters, (6) a requirement for reasonable assurances that use of waters will not violate water pollution stan-

dards, (7) acid mine drainage research, (8) pollution control in the Great Lakes, (9) land acquisitions for field laboratories to study pollution, (10) oil pollution removal research, (11) extension of the basic existing research authorization, (12) development of knowledge on the effects of pesticides, and (13) a training program to provide trained personnel to operate sanitary facilities. Concern was expressed by certain House members in the following areas: (1) possibility of delay due to the complex system, (2) the meaning of the term 'reasonable assurances', (3) whether the Act would apply to wholly intra-state water, and (4) cost of the Act. (Robinson-Florida)

FINANCIAL RESPONSIBILITY FOR OIL POL-LUTION CLEANUP.
Federal Maritime Commission, Washington, D.C.

Federal Register, Vol 36, No 35, p 3263-3264 (Feb 20, 1971). 2 p.

Descriptors: \*Water pollution control, \*Oily water, \*Damages, \*Administrative decisions, Legislation, Regulation, Ships, Cleaning, Federal government, Administrative agencies, Legal aspects, Federal jurisdiction, Oil wastes, Oil, Pollution abatement, Administration, Pollutants, Water pollution, Water policy, Water quality, Water quality control.

Pursuant to section 4 of the Administrative Procedure Act and sections 11 (p) (1), 11 (p) (2), and 11 (p) (3) of the Federal Water Pollution Control Act, as amended by the Water Quality Improvement Act of 1970, General Order 27 of the Federal Maritime Commission, dealing with financial responsibility for oil pollution cleanup, is herein amended. The essence of the amendment is that language is added to certification forms indicating that insurers shall be entitled to invoke all rights and defenses. Parties who have already submitted Certificate of Insurance Forms, Surety Bond Forms, and Guarantee Forms may submit a substitute form with the clarifying language. The use of these forms, with or without the new language, will be acceptable to the Commission as evidence of financial responsibility. These amendments do not substantially change any existing requirements but are merely for the purpose of clarifying the Commission's intent and aligning the language of the rule more closely with the language of the enabling statute. (Robinson-Florida) W71-09432

AN ACT IN RELATION TO WATER SUPPLY, DRAINAGE, SEWAGE, POLLUTION, AND FLOOD CONTROL IN CERTAIN COUNTIES. Public Act 76-2435, Illinois Legislative Service, p 558 (1970) amending Illinois Annotated Statutes ch 34, secs 3114, 3116.

Descriptors: \*Illinois, \*Water pollution control, \*Local governments, \*Administrative decisions, Administrative agencies, State governments, Legislation, Water supply, Drainage, Sewage, Flood control, Pollution abatement.

An Illinois statute concerning water supply, drainage, sewage, pollution, and flood control in certain counties, is amended to provide that: (1) before work is commenced under the Act, the plans shall be approved by the Environmental Protection Agency and the Department of Public Works and Buildings; and (2) county boards shall have authority to prevent and abate water pollution, although their authority in this respect does not exceed that of the state Pollution Control Board. (Hart-Florida) W71-09433

WATER QUALITY STANDARDS (PROCEDURE FOR REVISION).

Environmental Protection Agency, Washington,

Federal Register, Vol 36, No 68, p 6762-6764 (Apr 8, 1971), 3 p.

Descriptors: \*Water quality control, \*Water pollution control, \*Administrative decisions, \*Conferences, Water quality, Water resources, Legal aspects, Federal government, State government, Administration, Administrative agencies, Regulation, Standards, Water pollution.
Identifiers: \*Water Pollution Control Act.

Pursuant to the Federal Water Pollution Control Act the Administrator of the Environmental Protection Agency proposes new regulations concerning water quality standards. The Administrator or the governor of any state may seek to revise water quality standards. If the Administrator desires revisions he shall call a conference. If a governor wishes to revise water quality standards he shall request the Administrator to initiate a conference, and he shall submit the following: (1) a description of the location and nature of the interstate waters involved, standards to be revised, and the nature of the revision and reasons therefor; (2) a copy of the water quality standards with proposed deletions marked; (3) a summary of any public hearing held; and (4) an opinion by the State Attorney General that the proposed revisions have been adopted by the state if such is the case. The following areas relating to such a conference are detailed: (1) notice of conference; (2) service of notice; (3) parties; (4) organization and general procedures of the conference; (5) presentation of material; (6) conference procedure; (7) record of proceedings; and (8) preparation, publication, and promulgation of water quality standards. (Robinson-Florida) W71-09434

SALINE WATER CONVERSION ACT OF 1971 (A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO CONTINUE RESEARCH AND DEVELOPMENT FOR THE TREATMENT OF SALINE AND OTHER CHEMICALLY CONTAMINATED WASTE WATER TO MAINTAIN OR IMPROVE THE QUALITY OF WATER).

Senate Bill 991, 92d Cong, 1st Sess (1971). 12 p.

Descriptors: \*Desalination processes, \*Waste water treatment, \*Water quality control, Water treatment, water quanty control, \*Desalination, Desalination plants, Water quality, Water sources, Water supply, Water resources, Water resources development, Water pollution, Water pollution treatment, Water purification, Water treatment, Byproducts, Desalination apparatus, Water reuse, Grants, Research and development, Federal government, State governments, Administration, Administrative agencies.

Under this proposed legislation the Secretary of the Interior would be authorized to: (1) conduct and promote research to develop processes for the conversion of saline water, (2) pursue opportunities arising during research, (3) conduct engineering and technical work, (4) study methods for the marketing of byproducts, and (5) undertake economic studies. The Secretary would also: (1) explore potential cooperative agreements with non-federal governmental entities, (2) recommend the earliest opportunity for the construction of desalting plants, (3) utilize the expertise of other federal agencies, and (4) accept financial or other assistance from any state or public agency. In carrying out his functions the Secretary may: (1) make grants to educational and scientific organizations; (2) acquire services of required types of personnel; (3) utilize federal laboratories; (4) establish necessary facilities; (5) acquire secret processes, technical data, inventions, patents, licenses, land and plants; (6) gather scientific literature; (7) conduct on-site inspections; (8) foster and participate in conferences; (9) coordinate, correlate, and publish information; and (10) cooperate with other federal departments, with state and local departments, and with interested persons. All research will be conducted so that the developments will be available to the general public. Nothing in this bill would alter

existing law as to ownership and control of water. (Robinson-Florida) W71-09435

A BILL TO REQUIRE THE SECRETARY OF THE ARMY, ACTING THROUGH THE CHIEF OF ENGINEERS, TO ENGAGE IN PUBLIC WORKS FOR THE PREVENTION AND CONTROL OF WATER POLLUTION.
Senate Bill 1009, 92d Cong, 1st Sess (1971). 2 p.

Descriptors: \*Water pollution control, \*Sanitary engineering, \*Sewage treatment, \*Waste water treatment, Water pollution, Pollution abatement, Pollutants, Federal government, Projects, Water pollution sources, Sewage, Wastes, Environmental sanitation, Sewage disposal, Storm runoff, Waste water disposal, Waste water (Pollution), Waste treatment, Water purification, Water treatment, Research and development, Construction, Dredging.

This proposed legislation would provide that the Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to undertake, in the civil works program, projects for research, development, demonstration, and construction (including dredging) of works for the collection, purification, storage, and reuse of storm waters, sewage, and water-borne waste, for the purpose of preventing, abating, and controlling water pollution. Those projects shall have priority which reflect the most favorable ratio of environmental benefits to costs. Projects authorized by this bill would be subject to all the applicable provisions of law relating to flood-control projects, as determined by the Secretary of the Army. (Robinson-Florida) W71-09436

**CLEAN WATER COMMITMENT ACT OF 1971** (A BILL TO PROVIDE A NATIONAL COMMITMENT FOR FINANCING OF EXPANDED PRO-GRAMS UNDER THE FEDERAL WATER POL-LUTION CONTROL ACT, TO ASSURE BETTER COORDINATION IN DEVELOPMENT OF CLEAN WATER PROGRAMS).

Senate Bill 1143, 92d Cong, 1st Sess (1971). 7 p.

Descriptors: \*Water pollution control, \*Government finance, \*Water quality, \*Pollution abatement, Water pollution, Water quality control, Administrative agencies, Federal government, State governments, Legislation, Legal aspects, Grants.

To provide a national commitment of \$15 billion for financing of expanded programs under the Federal Water Pollution Control Act and for better coordination in development of clean water programs, this bill entitled the Clean Water Commitment Act of 1971 is proposed. In state determinations of project priority, primary emphasis must be placed upon effectiveness of individual projects in abating water pollution and improving water quality. Limitations of federal grants under the program are: (1) projects must be approved by the state water pollution agency and the Secretary, and must be included in a comprehensive plan; (2) enforceable water quality standards must be established for affected waters; (3) grants are limited to 75% of project cost; (4) grantees must agree to pay the remaining cost; (5) efficient operation and maintenance must be assured; and (6) projects must conform to state water pollution control plans. Seventy-five per cent of available funds are allocated to the state on a population basis; the remainder are designated for abatement of the most severe water pollution problems. An annual reporting and accounting to Congress is required. (Hart-Florida) W71-09437

A BILL TO REGULATE THE DISCHARGE OF WASTES IN TERRITORIAL AND INTERNA-TIONAL WATERS UNTIL FIVE YEARS AFTER

## Field 06—WATER RESOURCES PLANNING

## Group 6E-Water Law and Institutions

THE ENACTMENT OF THE ACT AND TO PROHIBIT SUCH DISCHARGE THEREAFTER. Senate Bill 1082, 92d Cong, 1st Sess (1971). 8 p.

Descriptors: \*Permits, \*Oceans, \*Research and development, Continental shelf, Technology, Grants, Administrative agencies, Federal government, Shipper oranis, Administrative agencies, receiving ment, Ships, Legal aspects, Government finance, Ecology, Environment, Water pollution, Water pollution control, Water quality, Water quality control, Marine animals, Marine plants, \*Waste disposal, Regulation, Waste dumps, Wastes.

Five years from enactment of this proposed legislation, discharge of wastes into territorial or international waters would be prohibited. In the interim period, discharge would be permitted only under permit from the Administrator of the Environmental Protection Agency. Permits would only be issued when the Administrator determined that marine ecology would not be harmed by the discharge. Furthermore, no permits would be issued for discharging sites between the continental shelf and the United States coast, and the Administrator would have authority to bar discharge of any specific matter deemed deleterious to the marine environment. Ocean dumping sites could be designated by the Administrator. Violation would be punished by civil fine. Additionally, the Administrator would conduct research and demonstration projects to determine methods of using and disposing of wastes normally dumped at sea. Private agencies as well as state and local governments would be encouraged and assisted by the Federal grants would be available for these activities. (Hart-Florida)
W71-09438

ACID MINE DRAINAGE (INDUSTRY ATTEMPTS TO DESCRIBE AND SOLVE POLLU-TION PROBLEMS).

For primary bibliographic entry see Field 05G. W71-09439

WASTE DISPOSAL IN DEEP WELLS.

National Industrial Pollution Control Council, Washington, D.C. For primary bibliographic entry see Field 05E. W71-09440

1969 FISH KILLS CAUSED BY POLLUTION (STATISTICAL REPORT).

For primary bibliographic entry see Field 05B.

NUISANCE LAW AS AN ENVIRONMENTAL TOOL, David G. Warren.

Wake Forest Law Review, Vol 7, No 2, p 211-229, 1971. 19 p, 110 ref.

Descriptors: \*North Carolina, \*Water pollution control, \*Pollution abatement, \*Public rights, Legal aspects, Water law, Water pollution, State governments, Local governments, Cities, Environ-ment, Social aspects, Environmental sanitation, Public health, Water quality, Water quality control.

North Carolina recognizes actions of public and private nuisance. An historical background of nuisance law is provided. Forms of actions based on public nuisance, private nuisance, negligence, and tresspass are discussed and compared. Private and public remedies of damages, injunctive relief, and abatement by self-help are discussed. The effectiveness of nuisance as a tool of environmental control is examined with reference to the use of nuisance by municipalities, counties, and local boards of health. The author concludes that North Carolina's nuisance laws are uncertain and confused and feels that actions for public and private nuisance should be preserved by law, broadened in scope, clarified, and used more often. Nuisance has on occasion been successfully used for environ-

mental control but may become ineffectual. The mental control but may become ineffectual. The author, lists several possibilities: (1) return to common law approaches exclusively, (2) abolish all nuisance actions not based on specific laws, or (3) empower private citizens to bring nuisance actions on behalf of the state. The last possibility is favored. (Robinson-Florida)

RIVERS, LAKES, AND STREAMS--REGU LA-

Public Act 76-2453, Illinois Legislative Service, p 579-581 (1970) amending Illinois Annotated Statutes ch 19, secs 61a, 65.

Descriptors: \*Illinois, \*Permits, \*Lake Michigan, \*Landfills, Legislation, Administration, Administrative decisions, Administrative agencies, Water pollution, Water pollution sources, Water pollution control, Water use, Water supply, Lakes, Streams, Rivers, Water quality, Water quality control, Pollution abatement, Legal aspects, Structures.

An Illinois statute concerning regulation of rivers, lakes, and streams is amended to provide for close cooperation between the Pollution Control Board, Environmental Protection Agency, Illinois Institute for Environmental Quality, and the Department of Public Works and Buildings, especially for preservation of Lake Michigan. The Environmental Protection Agency is directed to abate pollution of Lake Michigan and regularly conduct water quality surveys in it, making results available to all interested parties. Futhermor, the amendment makes landfills or construction in public waters unlawful absent a permit from the Department of Public Works and Buildings. Permits may not be issued for construction in Lake Michigan without concurrence by the Pollution Control Board. Violation of the statute is punishable by fine and imprisonment. Building of causeways, harbor, or mooring facilities in Lake Michigan must be approved by the legisla-ture; structures erected in violation may be abated as purprestures. Permits may be granted by the Department of Public Works and Buildings for use of public water. Where a permit is sought for construction of land-fills in public waters, the Department shall require, as a condition precedent, approval by riparian owners affected by the structure. (Hart-Florida) W71-09443

## TAXATION-POLLUTION CONTROL FACILI-

Public Act 76-2451, Illinois Legislative Service, p 577-578 (1970) amending Illinois Annotated Statutes ch 120, sec 502a.

Descriptors: \*Illinois, \*Pollution abatement. \*Taxes, \*Administrative decisions, Administrative agencies, Air pollution, Water pollution, Water pollution control, Water quality, Water quality control, Legislation, Legal aspects, Treatment

The Illinois Revenue Act is amended to define 'pollution control facilities' as facilities operated for the primary purpose of controlling air or water pollution, as defined in the Environmental Protection Act, or for the primary purpose of treating sub-stances which if released untreated would be deleterious to the environment. The Pollution Control Board shall certify pollution control facilities for tax purposes. Application for a pollution control facility certificate shall be filed with the Pollution Control Board, as required by its procedure, and the Board will issue a certificate to conforming facilities, which will receive preferred tax treat-ment for the period certified. Hearings must be provided before denial of certification. The Board may revoke certification on its own motion when: (1) fraud exists, (2) the certificate holder has substantially failed to proceed with operation of the facility, or (3) the facility has ceased to be used for pollution control. Written notice of the Board's action shall be furnished applicants. Any aggrieved applicant or holder may appeal pursuant to the Administrative Review Act. (Hart-Florida)

W71-09444

AN ACT IN REALTION TO PREVENTION AND ABATEMENT OF AIR, LAND AND WATER POLLUTION.

Public Act 76-2434, Illinois Legislative Service, p 557-558 (1970) amending Illinois Annotated Statutes ch 14, secs 11, 12.

Descriptors: \*Illinois, \*Pollution abatement, \*Air pollution, \*Water pollution, Legislation, Judicial decisions, Legal aspects, Water pollution control, Administrative agencies, Administrative decisions.

Definitions of the terms 'air pollution', 'water pollution', and 'land pollution' correspond to their respective definitions under the Environmental Protection Act, under this amendment to an Illinois Statute concerning abatement of air and water pol-lution. Furthermore, the Attorney General is empowered to prevent pollution by instituting proceedings in the circuit court of the county where the pollution is occurring. The court shall specify a time for answer, which shall be within 21 days of service of process, and issue an interim tem-porary restraining order. After default or answer, the court shall inquire into the alleged pollution and provide an appropriate order. Appeals from final orders are taken in the normal manner. The title of the Act is amended to read 'An Act in relation to the prevention and abatement of air, land and water pollution'. (Hart-Florida) W71-09445

#### AN ACT TO CREATE SANITARY DISTRICTS IN CERTAIN LOCALITIES.

Public Act 76-2436, Illinois Legislative Service, p 558-559 (1970) amending Illinois Annotated Statutes ch 42, sec 260.

Descriptors: \*Illinois, \*Water districts, \*Drainage, \*Sewage disposal, Cities, Administrative agencies, Local governments, Public utilities, Treatment facilities, Streams, Legislation.

An Illinois statute concerning creation of sanitary districts for drainage and the disposal of sewage is amended to provide that the Board of Trustees shall have power to: (1) do everything necessary to establish waste treatment plants; (2) alter the course of, or enlarge, any watercourse and extend it into an incorporated area; (3) contract with the city for use of the treatment works by the city for reasonable compensation, with increased costs of its use to be paid by the city; (4) maintain the projects established; and (5) extend work beyond the limits of the district, provided that no taxes may be levied beyond the district, and the district shall be liable for damages incurred beyond its limits. (Hart-Florida) W71-09446

GIBSON V CITY OF TAMPA (DISCHARGE OF MUNICIPAL SEWAGE INTO COASTAL WATERS).

154 So 842-843 (Fla 1934).

Descriptors: \*Florida, \*Municipal wastes, \*Water pollution, \*Pollution abatement, Sewage, Sewage disposal, Sewage treatment, Sewerage, Oysters, Shellfish, Cities, Domestic wastes, Water pollution sources, Waste treatment, Environmental sanitation, Impaired water quality, Pollutants, Treatment, Wastes, Water quality, Judicial decisions, Legal aspects, Remedies.

Plaintiff oyster grower sought to enjoin defendant city from discharging untreated sewage into coastal waters, to the detriment of plaintiff's oyster beds. The Supreme Court of Florida held plaintiff had not made a clear showing that equitable relief was justified, and thus affirmed the dismissal of plaintiff's being the contract of th tiff's bill of complaint. The court pointed out that the dismissal was without prejudice to plaintiff's rights, if any, to maintain an action at law to redress the alleged injury. (Madsen-Florida) W71-09447

REUSS V MOSS-AMERICAN, INC (AUTHORI-TY FOR CITIZEN TO BRING QUI TAM ACTION FOR VIOLATION OF RIVERS AND HAR-BORS ACT). 323 F Supp 848-850 (ED Wis 1971).

Descriptors: \*Rivers and Harbors Act, \*Wisconsin, \*Federal government, \*Water pollution, Water pollution control, Water pollution sources, Water quality, Water quality control, Navigable waters, Legislation, Administrative decisions, Legal aspects, Judicial decisions.

Plaintiff citizen filed an action against defendant corporation for violation of the Rivers and Harbors Act. Defendant moved to dismiss, contending that only the Department of Justice can bring proceedings for violation of the Act. 33 U.S.C. Section 413 provides that the Justice Department shall conduct the legal proceedings necessary to enforce the provisions of section 407. Plaintiff based his action for violation of section 407 upon section 411, which provides for payment of part of the assessed fine to the person giving information which shall lead to conviction under section 407. Plaintiff contended that an informer may proceed with a civil action if the government fails to prosecute when a statutory reward is available. The United States District Court for the Eastern District of Wisconsin, however, found no implied right to bring a qui tam action under the Rivers and Harbors Act, because of the express provision for prosecution by the Department of Justice. Hence, defendant's mo-tion to dismiss was granted. (Hart-Florida) W71-09448

## STATE V SLOTNESS (TRUST DOCTRINE LIMITED TO WATER-CONNECTED PUR-POSES).

185 NW 2d 530-534 (Minn 1971).

Descriptors: \*Minnesota, \*Lake Superior, \*Ownership of beds, \*Condemnation, Riparian land, Lake beds, Relative rights, Project purposes, Artificial use, Earth fill, Legal aspects, Judicial decisions, Eminent domain, Navigation.

Defendant riparian landowner had by landfill created new dry land extending from the low water mark of his upland property to the point of navigability of Lake Superior. Plaintiff state sought to condemn this fill land without payment of compensation to defendant. Plaintiff sought a declaratory judgment regarding compensation, claiming that, since the bed of the lake was held in trust for the people, defendant only held the filled portion of land as a tenant at sufferance. This claim postulated that one purpose of the trust doctrine was the holding of the lake bed for a public highway. De-fendant contended that his rights in the filled land were limited only by the public right in exclusively water connected uses. The Minnesota Supreme Court, holding for defendant, declared that construction of a public highway was strictly a land use and not remotely connected with navigation or any other water connected public use. Compensation must be paid in such cases unless the condemnation is solely in aid of navigation. (Kohla-Florida) W71-09449

#### 6F. Nonstructural Alternatives

PRELIMINARY REPORT ON WIND-TIDE FLOODING IN NEW HANOVER COUNTY,

NORTH CAROLINA.
Corps of Engineers, Wilmington, N.C.
For primary bibliographic entry see Field 04A.
W71-09335

FLOOD PLAIN INFORMATION, WILLAMETTE RIVER, JOHNSON, KELLOGG, AND MT. SCOTT CREEKS, MILWAUKIE-OAK GROVE-LAKE OSWEGO, OREGON.

Corps of Engineers, Portland, Oreg. For primary bibliographic entry see Field 04A. W71-09336 FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, HURON RIVER, NORWALK CREEK.

Corps of Engineers, Buffalo, N. Y.
For primary bibliographic entry see Field 04A.
W71-09337

FLOOD PLAIN INFORMATION, QUACHITA RIVER, BAYOU LAFOURCHE AND TRIBUTA-RIES, MONROE, LOUISIANA.

Corps of Engineers, Vicksburg, Miss. For primary bibliographic entry see Field 04A. W71-09338

SPECIAL FLOOD HAZARD INFORMATION REPORT ON ECONLOCKHATCHEE RIVER, AND SEMINOLE COUNTIES, FLORIDA

Corps of Engineers, Jacksonville, Fla. For primary bibliographic entry see Field 04A. W71-09339

FLOOD PLAIN INFORMATION, VERMILION RIVER, SKELLENGER CREEK, AND BONNEY

Corps of Engineers, Buffalo, N. Y. For primary bibliographic entry see Field 04A. W71-09340

A FLOOD INSURANCE MODEL FOR SHARING THE COSTS OF FLOOD PROTECTION. Central Connecticut State Coll., New Britain.

Dept. of Economics. For primary bibliographic entry see Field 04A. W71-09402

### 6G. Ecologic Impact of Water Development

A PRELIMINARY BIBLIOGRAPHY OF MATHEMATICAL MODELING IN ECOLOGY, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W71-09025

AN INTRODUCTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS IN ECOSYSTEM MODELS,

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W71-09026

**GUIDELINES FOR AGENCY STATEMENTS ON** PROPOSED FEDERAL ACTIONS AFFECTING THE ENVIRONMENT.

Council on Environmental Quality, Wash, D.C. For primary bibliographic entry see Field 06E. W71-09208

THE COSSATOT RIVER --- ANOTHER LEGAL MILESTONE.

Don G. Cullimore.

American Forests, Vol. 77, No. 5, p. 8-10, May 1971, 61, 2 figures.

Descriptors: \*Cost-benefit analysis, \*Legal aspects, \*Institutional constraints.
Identifiers: \*Cossatot River, Arkansas, National

Environmental Policy Act.

The author describes a landmark decision by a U.S. District Court judge in Arkansas forbidding construction of a dam across the Cossatot River in Arkansas because of noncompliance with the National Environmental Policy Act of 1969. Although ten million dollars had already been spent on the project, the author explains that the dam itself had not been contracted for. The controversy centered around the definition of costs and benefits of the project. (Holmes-Rutgers) W71-09406

## INTEGRATED RESOURCE MANAGEMENT.

I. W. Varty.

The Forestry Chronicle, Vol. 47, No. 1, p. 19-21, Feb. 1971, 8 references.

Descriptors: \*Resource allocation, \*Project planning, \*Social aspects, \*Political aspects.
Identifiers: \*Canada, Canadian Water Act, Canadi-

This article is a summation of views expressed at the Acadian Entomological Society Symposium held September 2, 1970, at the University of New Brunswick on the entomologist's role in integrated resource management. The participants stressed the need for long range planning, adherence to well defined goals, and better coordination of bodies regulating the legislation on pollution as well as more ecological research on the effects of pollutants. (Holmes-Rutgers) W71-09407

## WHAT'S HAPPENING TO OUR SALT WATER

New York State Dept. of Environmental Conservation, Albany. Div. of Marine and Coastal

John J. Spagnoli. The Conservationist, Vol. 25, No. 5, p. 22-27, April-May 1971, 2 figures, 9 ref.

Descriptors: \*Marsh management, \*Plant ecology, \*Salt marshes.

The author describes the characteristics and benefits of salt marshes, explaining the natural as well as unnatural successions that take place. He details the effects of environmental pollutants on the salt marshes and repeats the arguments in favor of salt marsh protection. He cites particularly Dr. Odum's measurements of high annual production of dry matter in salt marshes because of their ability to fix organic matter from sunlight. (Holmes-Rutgers) W71-09410

#### TURNABOUT ON THE CHATTOOGA.

Don G. Cullimore.

American Forests, Vol. 77, No. 2, p. 12-15, Feb. 1971, 55, 56, 2 figures.

Descriptors: \*Water resource development, \*Environmental effects, Cost-benefit analysis. Identifiers: Chattooga River, Wild and Scenic Rivers Act.

The story of how and why the four dams on the Chattooga River in northeastern Georgia were not constructed by the U.S. Army Corps of Engineers is described in this article. In contrast to previous situations, where the author explains that the corps has decided to build or not to build dams on the basis of construction costs and economic returns, in this case the decision was made on the basis of environmental concerns. Even though the construction of the four dams had been approved by congress, the river was declared a wild and scenic river and therefore not to be dammed up. (Holmes-Rutgers) W71-09411

THE SEAS - BEGINNING OR END, For primary bibliographic entry see Field 07B.

#### 07. RESOURCES DATA

#### 7A. Network Design

A PROPOSED STREAMFLOW DATA PRO-GRAM FOR TEXAS, Geological Survey, Austin, Tex. C. R. Gilbert, and R. O. Hawkinson.

## Field 07—RESOURCES DATA

## Group 7A-Network Design

Geological Survey Open-file Report (Texas Dist No 126), Mar 1971. 52 p, 3 fig, 1 plate, 5 tab, 11

Descriptors: \*Streamflow, \*Data collections, \*Network design, \*Texas, Reviews, Evaluation, Programs, Project planning, Stream gages, Hydrologic data, Gaging stations, Regression analysis, Reservoirs, Surface waters, Natural flow, Regulated flow, Discharge measurement, Flow rates, Flow characteristics, Streamflow forecasting.

An evaluation of the streamflow data available in Texas was made to provide guidelines for planning future programs. The basic steps in the evaluation procedure were: (1) Definition of the long-term goals of the streamflow-data program in quantita-tive form; (2) examination and analysis of all available data to determine which goals have al-ready been met; and (3) consideration of alternative programs and techniques to meet the remaining objectives. Although the present naturalstreams data program in the eastern two-thirds of the State was found to be adequate, data collection in the regulated-streams systems is deficient. Data collection is needed to define the inflow-outflow characteristics at eight additional reservoirs on minor streams. Additionally, gaging of outflow is needed at six reservoirs on minor streams and at five reservoirs on principal streams where reservoir-contents data are presently collected. One additional gaging station is needed to monitor outflow from systems of floodwater-retarding reservoirs in the Trinity River basin south of Dallas. (Woodard-USGS) W71-09094

NUMBER AND SPACING OF RAINFALL-GAUGES IN A DECIDUOUS FOREST STAND,

Wroclaw Univ. (Poland). Inst. of Botany; and Polish Academy of Sciences, Bialystok. Mammals Research Inst.

For primary bibliographic entry see Field 02B. W71-09138

## COMPUTERISED OPERATION OF DISTRIBU-

City Water Board, San Antonio, Tex. For primary bibliographic entry see Field 06A. W71-09224

PERENNIAL ICE AND SNOW MASSES--A GUIDE FOR COMPILATION AND ASSEMBLAGE OF DATA FOR A WORLD INVENTO-

For primary bibliographic entry see Field 02C. W71-09311

## A PROPOSED STREAMFLOW DATA PROGRAM FOR UTAH,

Geological Survey, Salt Lake City, Utah. G. L. Whitaker.

Geological Survey Open-file Report, 1971. 46 p, 4 fig, 4 tab, 14 ref, append.

Descriptors: \*Streamflow, \*Project planning, \*Network design, \*Data Hydrologic data, Reviews, Evaluation, Stream gages, Flow characteristics, Water yield, Water resources development, Gaging stations, Regression analysis.

Identifiers: Streamflow characteristics, (Utah), Basin characteristics, Program planning.

The streamflow data available for Utah are evaluated and guidelines for planning future programs are presented. The portions of the Bear River basin in Wyoming and Idaho were included in the Utah report. Records for 98 gaging stations, which were representative of natural flow, were analyzed for statistical characteristics. Twelve drainage-basin characteristics were compiled for each station. Multiple-regression analyses were performed by electronic computer to relate streamflow characteristics to basin characteristics. The streamflow

characteristics for ungaged sites in Utah could not be defined accurately enough by regression methods. The goals for current-purpose data are being met. Several existing sites were recom-mended as long-term trend stations. Programs for collecting data on stream environment are proposed. Also a network of gaging stations and alternate methods for achieving the goals for streamflow characteristics at ungaged sites are proposed. (Woodard-USGS) w71-09332

## 7B. Data Acquisition

AN INTRODUCTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS IN ECOSYSTEM MODELS,

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C.

TURBINE-DISCHARGE MEASUREMENTS BY CABLE-SUSPENDED CURRENT METERS, Corps of Engineers, Omaha, Nebr. Missouri River

For primary bibliographic entry see Field 08C. W71-09052

#### RADIOISOTOPES AND TURBINE FLOW MEA-SUREMENTS,

Bureau of Reclamation, Denver, Colo. J. C. Schuster, and R. L. Hansen

Paper American Society of Civil Engineers National Water Resources Engineers Phoenix, Ariz, Jan, 1971. 18 p, 4 fig, 1 tab. 6 ref, append.

Descriptors: \*Discharge measurement, \*Hydraulic turbines, Pipelines, \*Radioisotopes, Research and development, Experimental data, Tracers, \*Flow measurement, Accuracy, Fluid mechanics, Field tests, Laboratory tests, Radiation measuring equipment, Colorado.

Identifiers: Pole Hill Powerplant (Colo), Dilution

During 1965 to 1970, the Atomic Energy Commission and Bureau of Reclamation cooperated in a research program for measuring discharge through high-head turbines and pumps using radioisotopes. Purpose of the research was to develop a method for making discharge measurements accurately, quickly, and with a minimum of personnel and equipment. Measurements were made on the Flatiron Power and Pumping Plant penstock to compare the relative accuracy of using the radioisotope-velocity, integrated sample, dilution, and total-count methods. Measuring equipment was installed at the Pole Hill Powerplant for measuring turbine discharge at the single-unit plant. Results indicated no superiority of any of the 3 methods used to measure the discharge radioisotope. Discharge measurements showed consistent results with an accuracy of plus or minus 1.5%. General observations are given for all 4 radioisotope measurement methods. (USBR) W71-09066

# PREDICTION OF IN-SITU ACOUSTIC AND ELASTIC PROPERTIES OF MARINE SEDI-

MENTS, Naval Undersea Research and Development

For primary bibliographic entry see Field 02J. W71-09096

#### MULTIPLE CORER FOR SAMPLING PROFUNDAL BENTHOS,

Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 05A. W71-09158

APPLICATION OF ASSOCIATION-ANALYSIS TO DISTRIBUTION STUDIES OF RECENT FORAMINIFERA, Bedford Inst. Dartmouth (Nova Scotia). Atlantic

Oceanographic Lab.
For primary bibliographic entry see Field 05A.
W71-09177

RADIATION SURVEILLANCE - MONITORING THE ENVIRONS OF A NUCLEAR STATION, lowa-Illinois Gas and Electric Co. For primary bibliographic entry see Field 05A. W71-09249

## THE DEVELOPMENT OF A WIDE RANGE IMAGE SPECTRO PHOTOMETER INFORMA-TION SYSTEM, TRW Systems Group Redondo Beach, Calif. Keith P. Jenkin, and Richard C. Ramsey.

Available from the National Technical Information Service as AD-721 385, \$3.00 in paper copy, \$0.95 in microfiche. Naval Oceanographic Office Contract Report, 25 Feb 71. 101 p.

Descriptors: \*Water pollution, \*Remote sensing,

Post-riptors. Water pointion, 'Remote sensing,'
\*Oil wastes, \*Spectro photometry, Computers,
Data storage and retrieval.

Identifiers: \*Data processing systems, Airborne,
\*Ocean surveillance, Spectra Visible ... ultraviolet, Analog-to-digital converters, Computer storage devices, Display systems, Sensors, Spectrum signa-tures, WISP Widerange image spectrophotometers, \*Management information systems, Oil slicks, Oil pollution.

A data handling system was developed for WISP data. The procedure for the reduction of the raw flight data to graphic displays were refined in the program. Computed-generated maps are presented which enhance the various scene features and these are based upon the selection of the appropriate algorithms to fit the scene information. Polarization measurements of the airlight directed upward over the oceans were obtained up to 10,000 feet altitudes. The high subsection obtained suggest a significant gain in signal contrast will result from use of colors. result from use of polarizers in spacecraft ocean color sensors. Low altitude spectrometer flights over sewage outfalls and 'red tide' resulted in good correlation between the visible spectral nature of the upwelling light and ground truth turbidity and organisms counts. Useful algorithms were developed to best characterize the nature of the spectral data and the existing types of water pollution. Spectrometer measurements of a liberate oil spillage on the ocean indicated no visible signatures were present. W71-09258

#### NIMBUS WEATHER SATELLITES: REMOTE SOUNDING OF THE ATMOSPHERE, Gerald L. Wick.

Science, Vol 172, No 3989, p 1222-1223, June 18, 1971. 2 p, 5 ref.

Descriptors: \*Weather data, \*Satellites (Artificial), \*Remote sensing, \*Weather forecasting, \*Atmospheric physics, Meteorological data, Application methods, Water vapor, Infrared radiation, Air temperature, Research and development, Instru-

\*Weather Identifiers: satellites (Nimbus), \*Mapping (Weather).

Since inception in 1959 weather satellites have made a vast impact on the science of meteorology. From cameras in orbit cloud pictures and air movements could be determined--now a standard feature of weather forecasting--and infrared maps were made that show temperature variations. Instruments aboard Nimbus 3 (1969) and Nimbus 4 (1970) can now yield the vertical profile of air temperature between earth and the satellites. Global distribution of ozone and water vapor can also be measured. Carbon dioxide and temperature measurements techniques are described; and problems.

Publication

such as cloud cover that obscures radiation from the carth's surface, are discussed. Constant surveillance by Nimbus of global temperature patterns provides a unique opportunity to analyze known weather patterns and to spot previously unknown phenomena. It was found, for example, that the 1970 winter South Pole had two district cold regions at 45 Km where only one was expected. A British team and others observed 'sudden warmings' in the stratosphere over the winter North Pole where temperature over small areas may rise as much as 50 deg K in a few days. One year's highly successful operation in remote sounding of the atmosphere indicates an increasingly important source of data for meteorologists and others for the future. (Lang-USGS) W71-09271

## EFFECT OF CLAY ON THE ACCURACY OF THE HYDROMETER METHOD,

Indian Inst. of Tech., Kanpur. Dept. of Civil En-

gineering.
M. R. Madhav, and K. Subramanya.
Sedimentology, Vol 16, No 1-2, p 119-123, March
1971. 5 p, 3 fig, 1 tab, 3 ref.

Descriptors: \*Particle size, \*Hydrometry, \*Density, \*Clays, \*Settling velocity, Suspension, Viscosity, Particle shape, Clay minerals, Analytical techniques, Laboratory tests. Identifiers: \*Particle size analysis.

Even small collidal clay fractions in suspension affect markedly the results from a hydrometer test. The discrepancies are due to non-consideration of specific gravity and relative viscosity of the actual clay-water suspension. Therefore, actual (experimentally or otherwise determined) values of specific gravity and relative viscosity should be used instead of the conventionally used values. Another simple but time-consuming remedy is to remove the clay content from the soil by repeated decantation before conducting the hydrometer analysis. (Knapp-USGS)
W71-09284

## WATER ANALYSIS,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05A. W71-09289

## GEOLOGICAL OBSERVATIONS OF THE MIAMI TERRACE FROM THE SUBMERSIBLE BEN FRANKLIN,

Woods Hole Occanographic Institution, Mass. For primary bibliographic entry see Field 02J. W71-09290

MEASUREMENTS OF THE ENGINEERING PROPERTIES OF MARINE SEDIMENTS, Naval Academy, Annapolis, Md. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 02J.
W71-09291

## SOIL: A NATURAL SINK FOR CARBON MONOXIDE,

Stanford Research Inst., Irvine, Calif. For primary bibliographic entry see Field 02G. W71-09297

# FIELD STUDY OF SUBSURFACE SPENT SULFITE LIQUOR MOVEMENT USING EARTH RESISTIVITY MEASUREMENTS,

Research Council of Alberta, Edmonton. Earth Sciences Branch.

For primary bibliographic entry see Field 05B. W71-09302

#### EVALUATING GEOLOGIC HAZARDS WITH MULTIBAND PHOTOGRAPHY

San Francisco State Coll., Calif. Dept. of Geology. Raymond Pestrong.

Journal of Remote Sensing, Vol 2, No 2, p 4-9, Apr-May 1971. 6 p, 1 fig, 4 photo.

Descriptors: \*Remote sensing, \*Cameras, \*Aerial Descriptors: "Remote sensing, "Cameras, "Aerial photography, "Terrain analysis, Hydrology, Watersheds (Basins), Surface waters, Topography, Vegetation, Methodology, Geology, Groundwater, Identifiers: Drainage areas, Hydrologic regime.

A simple, effective multiband photographic system may be constructed from four synchronized 35 mm cameras, utilizing panchromatic black and white infrared, Kodachrome, and Ektachrome infrared films plus the appropriate filters. Such a system minimizes spectral duplication and provides unique photographic signatures for a variety of terrain features of interest to the land planner. All of the required films are readily available in 20-exposure 35 mm formats, thereby, facilitating utilization of the system with a minimum of specialized equip-ment. This type of analysis has been especially useful in the delineation of landforms along the margins of the San Francisco Bay, as well as for the location of large landslides in the nearby coast ranges. As the landslides disrupt drainage and vegetation, they show up most clearly on the Ektachrome infrared photographs. (Woodard-USGS) W71-09304

## SELF-OPERATED PIPETTE FOR GRAIN-SIZE ANALYSIS: A PROTOTYPE, Florence Univ. (Italy). Inst. of Geology.

Carlo Bartolini.
Sedimentology, Vol 14, No 3/4, p 295-308, July 1970. 14 p, 12 fig, 11 ref.

Descriptors: \*Silts, \*Analytical techniques, \*Particle size, \*Settling velocity, \*Automation, Suspension, Velocity, Mineralogy, Sedimentology, Sedi-

mentation rates.
Identifiers: \*Particle size analysis.

A self-operated pipette analyzes the silt fraction of a sample at half-phi intervals. Operator assistance is only required during the first four minutes of analysis. The procedure allows working three samples at a time twice a day. With a reduced height of fall nine samples could be easily treated in a working day. The total working time of the operator for the complete analysis of one sample (starting with already dispersed sample and including the weighing of the subsamples and the washing of the beakers) is about 30 min. (Knapp-USGS) W71-09318

# MINERAL STUDIES IN THE GRAVITATION-GRADIENT FIELD: 1. THE METHOD, Akademiya Nauk SSSR, Moscow. Geologicheskii

Institut

For primary bibliographic entry see Field 02J. W71-09322

#### THE SEAS - BEGINNING OR END,

George F. Bond.

Catalyst for Environmental Quality, Vol. No. 1, p. 9-13, Spring 1970. 5 figures.

Descriptors: \*Oceanography, \*Research facilities, \*Water pollution control. Identifiers: Sealab I, II, III, Genesis, Tektite.

The author describes the oceanographic research efforts that have been undertaken primarily by the U.S. Navy since inauguration of the Genesis project in 1957. He explains the importance of these projects in relation to the problems of environmental pollution, weather prediction, food, resources and fresh water deficiencies. He stresses the need to concentrate more efforts on ocean ecology and undersea engineering because 'in the last analysis, the sum total residue of man's environmental pollutants will come to rest in the seas.' (Holmes-Rutmers) W71-09413

## HYDROLOGIC STUDY OF THE YAGUEZ

7C. Evaluation, Processing and

# RIVER WATERSHED, Puerto Rico Univ., Mayaguez. Water Resources

Research Inst. Luis A. Nunez.

Available from the National Technical Information Service as PB-200 165, \$20.00 in paper copy, \$0.95 in microfiche. Technical Completion Report UPRICO-WRRI-FR-71-20-1 thru 11, Mar 1971, 11 Vol (1-7, 8A-8C, 9), dates vary. 1,348 p. OWRR Project A-020-PR (1).

Descriptors: Precipitation (Atmospheric), Runoff, Streamflow, \*Data collections, \*Hydrologic data, \*Climatic data, Puerto Rico, Watersheds (Basins). Identifiers: \*Yaguez River watershed.

Data are presented from 13 pluviometric stations of the Yaguez River basin in eleven volumes consisting of 16 appendices. Station data and summaries include: Descriptions of the 13 pluviometric stations and conclusions and recommendations; Monthly total precipitation; Mean monthly precipitation; Annual total precipitation; Mean intensity of precipitation; Normal discharge of Yaguez River (1967-1969); Flood discharge of Yaguez River (1968-1969); Meteorological records (1959-1970); Chart analysis of water level recorder; and Mean Intensity of Precipitation (1970). W71-08971

#### **SIMULATION** OF WATER RESOURCE

Maryland Univ., College Park. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 06A. W71-08974

## ECONOMIC-ECOLOGIC ANALYSIS IN THE CHARLESTOWN METROPOLITAN REGION:

AN INPUT OUTPUT STUDY,
Clemson Univ., S.C. Dept. of Agricultural
Economics and Rural Sociology. For primary bibliographic entry see Field 06A. W71-09002

#### PRELIMINARY BIBLIOGRAPHY MATHEMATICAL MODELING IN ECOLOGY, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 05C. W71-09025

## ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS - 1969,

Geological Survey, Austin, Tex.

C. C. Kidwell

Geological Survey Data Report, 1970. 32 p, 2 fig, 3

Descriptors: \*Surface waters, \*Hydrologic data, \*Data collections, \*Texas, \*Rainfall-runoff relationships, Floods, Storms, Flood control, Stream gages, Discharge measurement, Flow rates, Water quality, Chemical analysis, Meteorological data, Hydrographs, Mass curves, Small watersheds. Identifiers: \*North Creek (Tex), Trinity River basin (Tex), Floodwalls.

This report contains rainfall and runoff data for the 1969 water year for the 21.6-square-mile area above the stream-gaging station North Creek near Jacksboro, Texas. The location of proposed floodwater-retarding structures and hydrologic instruments are shown. The average rainfall during the 1969 water year was 32.94 inches, which is greater than the 12-year (1957-69) average of 31.02.

## Group 7C—Evaluation, Processing and Publication

Monthly rainfall totals ranged from 0.67 inch in January to 5.51 inches in May. Rainfall was scattered throughout the year with every month receiving some rainfall. The mean daily discharge at the stream-gaging station was 4.71 cfs, compared with the 13-year average of 5.98 cfs. The annual runoff was 3,410 acre-feet, or 2.96 inches. Computations included detailed time breakdous of rainfall and include detailed time breakdown of rainfall and discharge. Hydrographs and mass curves are drawn for illustration. Two chemical-quality samples were collected for analysis at the stream-gaging station North Creek near Jacksboro, Texas. The results of the chemical analyses are given. The water contained calcium and bicarbonate as the predominant ions. (Woodard-USGS) W71-09080

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA AND MUKEWATER CREEK, COLORADO RIVER BASIN, TEXAS,

Geological Survey, Austin, Tex. Water Resources

H. H. Hejl, Jr. Geological Survey Data Report, 1970. 84 p, 2 fig, 3

Descriptors: \*Streamflow, \*Rainfall-runoff relationships, \*Hydrologic data, \*Data collections, \*Texas, Small watersheds, Flow measurement, Stream gages, Runoff, Flow rates, Flow characteristics, Storms, Watershed management, Flood protection, Hydrographs, Mass curves, Reservoirs, Water storage, Water yield, Average flow. Identifiers: \*Mukewater Creek (Tex), Runoff com-

putations, Flood-retarding structures, Water budget.

This report contains the rainfall, runoff, and storage data collected during the 1969 water year for the 70.0-square-mile area above the streamgaging station Mukewater Creek at Trickham, Texas. All six of the floodwater-retarding structures in the Muke water Creek watershed are upstream from the stream-gaging station. The structures have a combined capacity of 5,790 acre-feet and control an area of 27.6 square miles, or 39% of the drainage area. The weighted-mean rainfall for the 1969 water year was 27.76 inches, or almost 114% of the 17-year (1953-1969) average of 24.45 inches. Monthly rainfall ranged from 0.04 inch in October to 4.96 inches in September. Mean daily discharge at the stream-gaging station was 3.91 cfs, compared with the 18-year average of 11.2 cfs. Annual runoff at the stream-gaging station was 2,830 acre-feet, or 0.76 inch. Three storms were selected for detailed computation including detailed time breakdown of rainfall and discharge. Hydrographs and mass curves are drawn for illustrations. (Woodard-USGS) W71-09083

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR CALAVERAS CREEK, SAN ANTONIO RIVER BASIN, TEXAS,

Geological Survey, Austin, Tex. Water Resources

J. M. Alexander.

Geological Survey Data Report, 1970. 56 p, 2 fig, 3

Descriptors: \*Streamflow, \*Rainfall-runoff relationships, \*Hydrologic data, \*Data collections, \*Texas, Average flow, Small watersheds, Flow measurement, Stream gages, Runoff, Flow rates, Flow characteristics, Storms, Watershed management, Hydrographs, Mass curves, Reservoirs, Flood control, Water storage, Water yield. Identifiers: \*Calaveras Creek (Tex), Flood-retard-

ing structures, Runoff computations.

This report contains the rainfall, runoff, and storage data collected during the 1969 water year for the 77.2 - square - mile area above the streamgaging station Calaveras Creek near Elmendorf, Texas. There are seven floodwater-retarding struc-

tures in the Calaveras Creek watershed. These structures have a capacity for temporary storage of 8,640 acre-feet of flood runoff from 26.6 of the 77.2 - square-mile study area. All but one of the structures are upstream from Calaveras Lake. The mean rainfall for the 1969 water year was 30.91 inches, or 112% of the 14 year (1955-68) weighted-mean average. The average monthlyrainfall totals ranged from 0.42 inch in July to 6.02 inches in November. Mean daily discharge at the stream-gaging station, Calaveras Creek near El-mendorf, was 1.16 cfs. This shows the effect of Calaveras Dam on the basin as the average discharge for the preceding 14 years was 10.7 cfs. Annual runoff at the stream-gaging station was 839 acre-feet, or 0.20 inch. Three storms were selected for detailed computations including detailed time breakdown of rainfall and discharge. Hydrographs and mass curves are drawn for illustrations. (Woodard-USGS) W71-09084

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1969, Geological Survey, Austin, Tex., Water Resources

Copies of report may be obtained at US Geological Survey, Water Resources Div, Federal Bldg, 300 E8th St, Austin, Tex, 78701. Geological Survey Data Report, 1970. 46 p, 3 fig, 1 tab.

Descriptors: \*Rainfall-runoff relationships, \*Urbanization, \*Cities, \*Hydrologic data, \*Texas, Data collections, Small watersheds, Watershed management, Streamflow, Flow measurements, Flow rates, Average flow, Runoff, Storms, Storm drains, Hydrographs, Mass curves, Water yield, Peak discharge.
Identifiers: \*Urban hydrology, \*Austin (Tex).

Rainfall and runoff data are presented for the Waller Creek and Wilbarger Creek study areas for the 1969 water year. The Waller Creek drainage area lies entirely within the city of Austin, with the headwaters originating in the northern part of the city. The creek flows south for 6.6 miles to the Colorado River. Storm sewers and street gutters divert runoff both into and out of the natural drainage area. The weighted-mean rainfall upstream from 38th Street was 30.25 inches. 7% below the mean annual rainfall for Austin of 32.58 inches. Mean daily discharge was 1.38 cfs; annual runoff was 8.08 inches, or 27% of rainfall. The headwaters of Wilbarger Creck originate in Travis County near the Williamson County line. The creek flows southeasterly about 40 miles to the Colorado River. The Wilbarger Creek study area is about 15 miles north of the city of Austin. Weighted-mean rainfall in this study area was 27.92 inches, 14% below the mean annual rainfall for Austin. Mean daily discharge was 1.49 cfs; annual runoff was 4.40 inches, or 16% of the rainfall. (Woodard-USGS) W71-09086

PUBLIC AND INDUSTRIAL WATER SUPPLIES IN SOUTHERN MISSISSIPPI.

Geological Survey, Jackson, Miss. J. A. Callahan.

Mississippi Board of Water Commissioners Bulletin 71-1, 1971. 61 p, 5 fig, 10 ref.

Descriptors: \*Water supply, \*Industrial water, \*Domestic water, \*Water resources development, \*Mississippi, Groundwater, Surface waters, Water yield, Water quality, Aquifer characteristics, Hydrologic data, Data collections, Public utilities. Water utilization, Pumping, Water storage, Chemical analysis, Withdrawal, Water wells, Water levels,

Identifiers: \*Public water supply, \*Industrial water

Data on the public and industrial water supplies of 37 counties in southern Mississippi are presented. 37 countes in southern Mississippi are presented.
Information for each public-supply system includes population served, average daily pumpage, storage, treatment, well descriptions, and chemical analyses if available. Estimated self-supplied industrial water use is given for each county, and industrial supply wells are described. Total public- and industrial-supply pumpage in 1970 amounted to 1,300 mgd. Of the 1,090 mgd pumped from surface-water sources, 540 mgd were brackish water from Back Bay of Biloxi and the Pascagoula River estuary. All public water supplies except those at Jackson and Meridian are obtained from aquifers of Eocene age and younger. Although the greater number of industrial supplies are obtained from Miocene aquifers most of the water pumped for industrial use is from surface sources. (Woodard-USGS) W71-09091

SIMULATION OF TIDAL MOTION IN COM-PLEX RIVER SYSTEMS AND INLETS BY A METHOD OF OVERLAPPING SEGMENTS,

Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch. For primary bibliographic entry see Field 02L. W71-09093

GROUNDWATER DATA AS OF 1967--COLORADO DESERT SUBREGION, CALIFOR-

Geological Survey, Menlo Park, Calif. Water Resources Div.

Geological Survey Open-file Report, Mar 5, 1969. 19 p, 1 fig, 50 ref.

Descriptors: \*Groundwater, \*Water wells, \*Hydrologic data, \*Aquifer characteristics, \*California, Reviews, Water table, Water levels, Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, Water quality, Chemical analysis, Dissolved solids, Aquifers, Hydrogeology, Water resources development.

Identifiers: \*Groundwater resources.

Most usable groundwater in the Colorado Desert Subregion occurs in the alluvium-filled valleys that occupy about half the subregion. The alluvium consists generally of lenticular beds of unconsolidated to semiconsolidated clay, silt, sand, and gravel of Cenozoic age. The intervening mountainous areas are underlain by consolidated sedimentary, igneous, and metamorphic rocks, mainly of Mesozoic age or older. These rocks contain only small quantities of recoverable groundwater. Total storage capacity of the 45 basins is nearly 158,000,000 acre-feet. The usable storage capacity has been determined only for Coachella Valley where it is 3,600,000 acre-feet. Groundwater temperature ranges from about 60 deg to about 90 deg F, but temperatures of more than 500 deg F have been observed locally. The dissolved solids content of the water varies greatly (from less than 600 to more than 300,000 parts per million), depending on local conditions. The predominant water type is sodium sulfate or sodium chloride. Properly constructed wells in some areas can yield as much as 3,900 gal-lons per minute. (Woodard-USGS) W71-09142

SUMMARY OF THE GROUNDWATER DATA AS OF 1967--CALIFORNIA REGION,

Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 02F. W71-09143

GROUNDWATER DATA AS OF 1967--NORTH

COASTAL SUBREGION, CALIFORNIA, Geological Survey, Menlo, Calif. Water Resources Div.

J. S. Bader.

Geological Survey Open-file Report, Mar 5, 1969. 11 p, 1 fig, 20 ref.

## Evaluation, Processing and Publication—Group 7C

Descriptors: \*Groundwater, \*Water Descriptors: \*Groundwater, \*Water wells, 
\*Hydrologic data, \*Aquifer characteristics, 
\*California, Water levels, Water table, Reviews, 
Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, 
Water quality, Dissolved solids, Chemical analysis, 
Aquifers, Hydrogeology, Water resources development.

Identifiers: \*Groundwater resources.

Most usable groundwater in the predominantly mountainous North Coastal Subregion occurs in widely scattered alluvium-filled valleys and coastal plains. The alluvium consists generally of lenticular beds of unconsolidated to semiconsolidated clay, silt, sand, and gravel of Cenozoic age. The intervening mountainous areas are underlain by consolidated sedimentary, igneous, and metamorphic rocks mainly of Mesozoic age or older. These older rocks contain only small quantities of recoverable groundwater. Total storage capacity of the 13 basins for which determinations have been made is nearly 1,000,000 acre-feet. The usable storage capacity is 700,000 acre-feet; the limiting factors are the possibility of sca-water intrusion and aquifer materials of low permeability. Groundwater temperature ranges from about 50 deg to about 70 deg F, but locally is as low as 43 deg and as high as 178 deg F. The dissolved-solids content of the water is generally less than 500 parts per million, but locally is more than 4,800 parts per million. The predominate water type is calcium bicarbonate. Properly constructed wells in some areas can yield as much as 4,000 gallons per minute. (Woodard-USGS)

## GROUNDWATER DATA AS OF 1967--SOUTH LAHONTAN SUBREGION, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.

Geological Survey Open-file Report, Mar 5, 1969. 25 p, 1 fig, 70 ref.

\*Groundwater, \*Water \*Hydrologic data, \*Aquifer characteristics,
\*California, Reviews, Water table, Water levels, Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, Water quality, Chemical analysis, Dissolved solids, Aquifers, Hydrogeology, Water resources develop-

Identifiers: \*Groundwater resources.

Most usable groundwater in the predominantly mountainous South Lahontan Subregion occurs in the alluvium-filled valleys. The alluvium consists generally of lenticular beds of unconsolidated to semiconsolidated clay, silt, sand, and gravel of Cenozoic age. The intervening mountainous areas are underlain by consolidated sedimentary, igneous, and metamorphic rocks, mainly of Mesozoic age or older. These rocks contain only small quantities of recoverable groundwater. Total storage capacity of the 50 basins is more than 134,000,000 acre-feet. The usable storage capacity has been determined only for Indian Wells Valley where it is 720,000 acre-feet. Groundwater temperature ranges from about 50 deg to about 80 deg F, but has been observed locally as high as 286 deg F. The dissolved-solids content of the groundwater varies widely (from less than 800 to more than 400,000 parts per million) from valley to valley. The predominant water type is sodium bicarbonate. Properly constructed wells in some areas can yield as much as 3,800 gallons per minute. (Woodard-USGS) W71-09145

## GROUNDWATER DATA AS OF 1967--NORTH LAHONTAN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif.

J. S. Bader

Geological Survey, Open-file Report, Jan 29, 1969. 8 p, 1 fig, 15 ref.

Descriptors: \*Groundwater, \*Water \*Hydrologic data, \*Aquifer characteristics, \*California, Reviews, Water table, Water levels, Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, Water quality, Chemical analysis, Dissolved solids, Aquifers, Hydrogeology, Water resources develop-

Identifiers: \*Groundwater resources.

Most usable groundwater in the predominantly mountainous North Lahontan Subregion occurs in scattered valleys that are filled with alluvium and material of volcanic origin. The intervening mountainous areas are underlain mainly by igneous rocks of Mesozoic and Cenozoic age. These rocks contain only small quantities of recoverable groundwater. Total storage capacity of seven of the eight basins is nearly 23 million acre-feet. However, the usable storage capacity has not been determined; the limiting factor is the quality of the water. Groundwater temperature ranges from about 50 deg to about 80 deg F, but locally is as high as 182 deg F. The dissolved-solids content of the water is generally less than 500 parts per million, but locally is as much as 2,030 ppm. The predominant water type is calcium bicarbonate. Properly constructed wells in some areas can yield as much as 3,800 gallons per minute. (Woodard-USGS) W71-09146

#### GROUNDWATER DATA AS OF 1967--SAN JOAQUIN BASIN SUBREGION, CALIFORNIA, Geological Survey, Menlo Park, Calif. J. S. Bader.

Geological Survey Open-file Report, Mar 5, 1969. 16 p, 1 fig, 112 ref.

\*Groundwater, \*Water wells. Descriptors: \*Hydrologic data, \*Aquifer characteristics, \*California, Reviews, Water table, Water levels, Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, Water quality, Chemical analysis, Dissolved solids, Aquifers, Hydrogology, Water Aquifers, Hydrogeology, Water resources develop-

Identifiers: \*Groundwater resources.

Nearly all usable groundwater in the San Joaquin Basin Subregion occurs in the alluvium-filled San Joaquin Valley. The aquifer system throughout the entire San Joaquin Valley is an integrated system; therefore, this report includes the Delta-Central Sierra Subregion, the Tulare Basin Subregion, and the San Joaquin Basin Subregion. Total storage capacity of the San Joaquin Valley is 93 million acre-feet. The usable storage capacity is 80 million acre-feet; low permeability in some areas is considered a limiting factor. Groundwater temperature ranges from about 45 degrees to about 105 degrees F. The dissolved-solids content of the water ranges from 64 to 10,700 parts per million. The predominant water type varies with the aquifer, but calcium, magnesium, sodium, bicarbonate, sulfate, and chloride are the main constituents. (Woodard-W71-09147

## GROUNDWATER DATA AS OF 1967--SACRA-MENTO BASIN SUBREGION, CALIFORNIA,

Geological Survey, Menlo Park, Calif. J. S. Bader.

Geological Survey Open-file Report, Mar 5, 1969. 16 p, 1 fig, 31 ref.

Descriptors: \*Groundwater, \*Water data, \*Aquifer characteristics, \*Hydrologic \*California, Reviews, Water table, Water levels, Water yield, Specific capacity, Withdrawal, Pumping, Groundwater recharge, Water temperature, Water quality, Chemical analysis, Dissolved solids, Aquifers, Hydrogeology, Water resources develop-

Identifiers: \*Groundwater resources.

Most usable groundwater in the predominantly mountainous Sacramento Basin Subregion occurs

in alluvium-filled valleys and volcanic rocks of Quaternary and Tertiary age. Total storage capacity of 17 of the 21 basins is nearly 55 million acrefeet, of which more than 33 million is in the Sacramento Valley. The usable storage capacity in the Sacramento Valley is 22 million acre-feet; the limiting factors are economic considerations, aquifer materials of low permeability, and the quality of the water. Groundwater temperature ranges from about 55 degrees to about 75 degrees Fa. The dissolved-solids content of the water is generally less than 55 parts per million, but locally is as much as 2,790 ppm. The predominant water type is calcium bicarbonate, but sodium and magnesium are present locally in significant quantities. Properly constructed wells in some areas can yield as much as 3,100 gallons per minute. (Woodard-ISGS) USGS) W71-09148

## A COMPUTER BASED FLORISTIC ANALYSIS

OF PAMLICO RIVER PHYTOPLANKTON, East Carolina Univ., Greenville, N.C. Dept. of

For primary bibliographic entry see Field 05A. W71-09211

## GRAPHICAL CONVERSION OF A STAGE HYDROGRAPH TO A DISCHARGE HYDRO-GRAPH.

Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02E.
W71-09275

# HYDRAULIC TESTING OF WELL HTH-23 IN CENTRAL NEVADA, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 02F. W71-09324

## HYDRAULIC TESTING OF WELL HTH-4 IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 02F. W71-09325

#### HYDRAULIC TESTING OF WELL HTH-3 IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 02F. W71-09326

#### HYDRAULIC TESTING OF WELL HTH-5 IN CENTRAL NEVADA,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 02F. W71-09327

# HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-1, IN CENTRAL NEVADA, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 02F. W71-09328

## HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-2, IN CENTRAL NEVADA, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 02F. W71-09329

#### HYDRAULIC TESTING AND SAMPLING OF HOLE Ue-3, IN CENTRAL NEVADA, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 02F. W71-09330

#### HYDRAULIC TESTING OF WELL HTH-21-1 IN CENTRAL NEVADA,

Geological Survey, Denver, Colo.

## Group 7C—Evaluation, Processing and Publication

For primary bibliographic entry see Field 02F. W71-09331

## 08. ENGINEERING WORKS

#### 8A. Structures

FIELD COMPARISON OF SEVERAL TRENCH AND GRAVEL ENVELOPE DESIGNS,
Bureau of Reclamation, Sacramento; and Califor-

nia Univ., Davis.
For primary bibliographic entry see Field 04A.
W71-09054

#### CALCULATION OF THE FOUNDATION OF ARCH DAMS.

F. G. Tskhadaia, V. S. Zhgenti, and G. N.

Khazaliia.

Bur Reclam Transl 847, Jan, 1971. 52 p, 4 fig, 23 tab, 2 ref, append. Trans. of Vychisl tsentr, Akad Nauk Gruz SSR Tbilisi, 1968.

Descriptors: Foreign design practices, Mathematical analysis, \*Arch dams, \*Dam foundations, \*Dam design, Hydraulic structures, Abutments, Design tools, Boundary values, Dams, Concrete dams, Foundations, Loads (Forces), \*Deformation, \*Displacements, Equations, Strain, Movement, Analytical techniques, Rotation, Formulas. Identifiers: Vertical displacements, Horizontal displacements, IISSR placements, USSR.

Vogt's method of analysis of arch dam foundations is modified to allow a parabolic distribution of load. Expressions for normal and horizontal displacement and angle change of the foundation are developed for normal, moment, and shearing loads. Lengthy expressions for constants used in the calculations which are a function of the foundation geometry and the location along the foundation are separated and identified. Tables of values for the constants are given for the expected range of foundation geometry and location along the foundation.
The geometrical description of the foundation used for determining the parameters of the tables is given. (USBR) W71-09071

#### TESTS FOR TUNNEL SUPPORT AND LINING REQUIREMENTS.

Bureau of Reclamation, Denver, Colo. G. B. Wallace, and W. H. Ortel.

Paper 12th Symposium on Rock Mechanics University of Missouri, Rolla, Mo, Nov, 1970. 27 p, 27 fig, 9 ref.

Descriptors: \*Tunnel linings, \*Tunnel supports, \*Rock pressures, Loads (Forces), Rock bolts, Safety, Tunnel design, \*Instrumentation, Measuring instruments, Pressure cells, Extensometers, Slope indicators, Analytical techniques, Strain meters, Strain gages, Rock mechanics, Deformation, In situ rock, Geology, Measurement. Identifiers: Load cells, Joint meters, Photoelastic

stress meters, Analytical method.

Tunnel measurements and their analysis may be the key that will give the insight necessary for understanding the relationship of rock, tunnel supports, and linings, resulting in improved safety, design methods, and geological interpretation of tunnel requirements. To accomplish these goals, the Bureau of Reclamation developed a tunnel instrument program to measure rock movement, loads on supports and linings, relative movement between rock and lining, and stresses in supports and lining. The instruments and the techniques used to install the instruments, as well as typical examples of output results are described. Instruments include tunnel diameter gage, single- and multiple-position extensometers, slope indicators, load and pressure cells, joint and strain meters, welded and bonded resistance strain gages, and photoelastic gages. (USBR)
W71-09076

DETERMINATION OF CHANNEL CAPACITY OF THE FRESNO RIVER DOWNSTREAM FROM HIDDEN DAMSITE, MADERA COUNTY,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 08B. W71-09092

## FLUID FORCE ANALYSIS AND ACCELERAT-

ING SPHERE TESTS, Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering; and Notre Dame Univ., Ind. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-09109

#### COASTAL REGIME - RECENT U. S. EX-PERIENCE,

Corps of Engineers, Washington, D.C. Coastal En-

gineering Research Center.
For primary bibliographic entry see Field 08B.
W71-09141

# NAVIGATION CONDITIONS AT LOCKS AND

Vicksburg, Miss. John J. Franco, and Cody D. McKellar, Jr.

Available from the National Technical Information Service as AD-720 548, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-736, Aug

Descriptors: \*Dams, \*Model studies, \*Flow, \*Test procedures, Navigation, Locks, Pennsylvania. Identifiers: \*Hydraulic models, Pennsylvania, Waterways, Monongahela River (Pa).

Existing Locks and Dam No. 4 consist of two parallel locks with clear chamber dimensions of 56 by 720 ft and 56 by 360 ft and a fixed dam 540 ft long. Reconstruction of Dam 4 will involve replacement of the existing fixed dam with a nonnavigable-type gated dam with five 84-ft-wide gates and four 10-ftwide piers. Provision will be made in the dam structure for ultimate replacement of the existing locks by two locks each 720 ft long, with one lock 84 ft wide and the other 110 ft wide. A 1:120-scale, fixed-bed model reproducing approximately 2.5 miles of the Monongahela River was used to determine the effect of the proposed reconstructed dam on flow conditions in the lock approaches with the existing and ultimate locks and for the development of modifications which might be required to provide satisfactory navigation conditions. Results indicated that stages upstream of the dam would be lowered and velocities in the upper approach would be increased during uncontrolled riverflows. The maximum flow at which navigation through the locks if feasible would be increased about 30 percent. With the lower stages and resulting higher velocities, tows would experience greater difficulties in approaching the existing locks. Conditions with the existing locks could be improved by construction of cells spaced about 20 ft apart as extensions to the existing guard wall; with the ultimate locks, ports should be provided in the upper guard wall to reduce or eliminate the strong crosscurrents near the end of the wall. Velocities in the upper lock approach could be reduced by deepening the channel along the left bank above the dam and by placing spoil on the channel bed on the right side. Removal of the spur dike upstream of the locks would increase velocities in the approach, but would improve the alignment of currents.

## NAVIGATION CONDITIONS AT BELLEVILLE LOCKS AND DAM, OHIO RIVER, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

For primary bibliographic entry see Field 08B.

#### 8B. Hydraulics

#### SMALL CHECK-DROP-ENERGY DISSIPATOR STRUCTURES.

Colorado State Univ., Fort Collins.

G. V. Skogerboe, V. T. Somoray, and W. R. Walker.

Paper 70-748, 1970 Winter Meet, American Society of Agricultural Engineers, Chicago, III, Dec, 1970. 16 fig, 8 tab, 23 ref.

Descriptors: Check structures, Drops (Structures), Discharge (Water), \*Energy dissipators, Bibliographies, \*Design criteria, Design, Hydraulic jump, \*Laboratory tests, Models, \*Model tests, Hydraulics, Research and development, Stilling basins, Spillways, Critical depth, Hydraulic structures,

Identifiers: Baffle blocks.

Existing information has been used extensively in developing design relationships for various geometric forms of check-drop-energy dissipator structures. Design criteria for numerous types of rigid boundary stilling basins are available, but much of the literature is concerned with particular structures for special use rather than general information. The material of general nature is scattered in numerous laboratory and project reports or design manuals. The problem is to evaluate existing information to determine what research is necessary for developing generalized design procedures. Once the necessary basic research is available, various types of structures can be designed, but verifying the designs by laboratory model studies will be desirable. Examples of check-drop-energy dissipator structures illustrate that information is available for designing rigid boundary stilling basins over a wide range of flow conditions. (USBR) W71-09075

#### DETERMINATION OF CHANNEL CAPACITY OF THE FRESNO RIVER DOWNSTREAM FROM HIDDEN DAMSITE, MADERA COUNTY. CALIFORNIA,

Geological Survey, Menlo Park, Calif. Gilbert L. Bertoldi, and J. C. Blodgett. Geological Survey Open-file Report, 1971. 45 p, 3 fig, 3 tab, 6 ref.

Descriptors: \*California, \*Flood routing, \*Channel improvement, \*Design flood, \*Flood protection, Flash floods, Maximum probable flood, Historic flood, Regional flood, River forecasting, Dikes, Flood control, Floodgates, Floodproofing, Cloudbursts, Peak discharge, Multiple-purpose projects, River basin development.

Identifiers: \*Madera County (Calif), \*Madera (Calif), \*Fresno River (Calif).

A channel capacity study was made in the general vicinity of the town of Madera some 25 miles northwest of Fresno, California to aid in the evaluation of a major flood control project in that area. This project included portions that had been inundated in the past and was especially designed to cover those areas affected by the flood of February 24-25, 1969. The adequacy of the existing channel was investigated using 89 flood profiles at various discharges ranging from 2,500 cfs to 18,000 cfs. Computed water-surface elevations indicate that discharges of 5,000 cfs and 8,000 cfs easily be contained within the channel. Upstream from the Railway bridge, a discharge of 10,000 cfs will cause local flooding. Flooding of agricultural land south of the Fresno River and between cross sections 64 and 68 could occur if a discharge of 10,000 cfs were routed entirely down the main channel. However, the South Fork normally carries flows when the main channel flow exceeds about 1,500 cfs. (Glasby-USGS) W71-09092

BEHAVIOR OF POROUS BED NEAR FLOW

SINGULARITY,
Karlsruhe Univ. (West Germany). Institut fuer
Hydromechanik, Straunanlagen and Wasserversorgung; and Georgia Inst. of Technology, Atlanta.
School of Civil Engineering.
For primary bibliographic entry see Field 02G.

FLUID FORCE ANALYSIS AND ACCELERATING SPHERE TESTS,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering; and Notre Dame Univ., Ind. Dept. of Civil Engineering.

Wallis S. Hamilton, and James E. Lindell.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY6, Paper 8195, p 805-817, June 1971. 13 p, 4 fig, 14 ref, append. NSF Grant No GK 479.

Descriptors: \*Earthquakes, \*Hydrodynamics, \*Earthquake engineering, Fluid friction, Pressure, Velocity, Hydrostatic pressure. Identifiers: Fluid force.

Large fluid forces are exerted on dams and other underwater structures when the structures are ac-celerated by earthquakes. Similarly, piles and offshore towers subjected to waves must be able to withstand large forces caused by the accelerating fluid. The accelerative force problems of interest to engineers frequently involve periodic motion, but nonperiodic motion also is important. Whether or not the motion is periodic, the presence of a sur-rounding fluid demands that the external force applied to a body to produce a stipulated acceleration be larger than would be required if the fluid were absent. The body behaves as if a mass in addition to its own were attached to it. This is the concept of added mass. The mean added mass coefficient from 24 acceleration tests on 4-inch and 6-inch spheres released from rest in water was 0.501. Because the added mass coefficient from inviscid theory is 0.50, the viscosity of the water did not influence the added mass. Seventy-eight measurements immediately after acceleration from nominally constant speeds of 0.1 fps to 0.7 fps showed no tendency of the coefficient to depend on speed or on whether the acceleration was in the same direction as the velocity or in the opposite direction. (Knapp-W71-09109

## SEEPAGE EFFECT ON CHANNEL BANK STA-

BILITY, Bureau of Reclamation, Denver, Colo. Hydraulics Machinery Branch; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 04A. W71-09110

#### CROSS-BEDDED TIDAL MEGARIPPLES FROM SOUND (NORTHWESTERN KING TRALIA),

Bureau of Mineral Resources, Geology and

Geophysics, Canberra (Australia). D. C. Gellatly. Sedimentary Geology, Vol 4, N-2, p 185-191, June 1970. 7 p, 5 fig, 1 tab, 11 ref.

Descriptors: \*Ripple marks, \*Sand waves, \*Sedimentary structures, \*Sediment transport, \*Tidal effects, Currents (Water), Tides, Bottom sediments, Sands, Channel morphology, Water level fluctua-

Identifiers: Cross-bedding.

Migration of megaripples and sand waves in shallow seas and estuaries suggests a possible model for the formation of widespread marine cross-bedding. Most examples have been studied only externally many of them from echo-sounding; their internal structure is unknown, but cross-bedding has been assumed. Megaripples in King Sound are exposed at low tide and their internal structure has been examined. Many are cross-bedded with steeply

dipping foresets. Facing of the foresets indicates that they may be developed by either indicates that they may be developed by either the flood or ebb tide. The current direction implied by external morphology appears to be a reliable guide to that indicated by the cross-bedding. (Knapp-USGS) W71-09122

# SKEWNESS AS AN ENVIRONMENTAL IN-DICATOR IN THE SOLANI RIVER SYSTEM, ROORKEE (INDIA), Oil and Natural Gas Commission, Ahmedabad (In-

dia).

For primary bibliographic entry see Field 02J. W71-09123

## COASTAL REGIME - RECENT U. S. EX-PERIENCE,

Corps of Engineers, Washington, D.C. Coastal Engineering Research Center.
Thorndike Saville, Jr., and George M. Watts.
Available as Army Corps of Engineers Coastal Engineering Research Center Reprint 3-70, June 1969. Reprint of Paper from 22nd International Navigation Congress, Section 2, Subject 4, Paris, 1969. 23 p, 14 fig, 28 ref.

Descriptors: \*Coastal engineering, \*Ocean waves, \*Littoral, \*Beaches, \*Sediment transport, Shore protection, Hydraulic structures, Model studies, Laboratory tests, Test procedures, Harbors, Beach erosion, Engineering structures. Identifiers: Wave forecasting.

Laboratory and field studies are discussed in developing a better understanding of the interaction of the beach and the littoral zones with and without manmade structures. Wave action is the most important factor influencing movement of sediments along U.S. shores. In many localities, the direction and rate of material movement may be determined directly from the rates of accretion and erosion at shore structures. Such determinations are accurate at the initial installation of the structure, or after cleaning a deposition area by a sand bypassing operation. Where there is no background of experience from shore structures, information on the direction (but not magnitude) of littoral movement can be obtained in many areas from the shore patterns near headlands where sediment accumulates on the updrift side, and an eroded embayment occurs on the downdrift side. A summary of major littoral factors pertinent to design of coastal works is included. (Woodard-USGS) W71-09141

#### RIVER BED DEGRADATION,

Asian Inst. of Tech., Bangkok (Thailand). Sadequr Rahman.

M Sc Thesis No 266, Asian Institute of Technology, 1969. 87 p, 31 fig, 4 tab, 22 ref, 4 append.

Descriptors: \*Streamflow, \*Channel erosion, \*Dams, Regulated flow, \*Sediment transport, Model studies, Flumes, Sediments, Particle size, Analytical techniques, Mathematical Shear, Stress analysis, Roughness coefficient, Equations, Channel morphology. Identifiers: Channel degradation.

The construction of a dam across a river changes the position of the streambed and water levels downstream from the dam. A study of these changes was made. Experimental investigation was conducted in a recirculating rectangular flume. The flume was 72 ft long, 2 ft wide and 2.5 ft deep. The sand bed layer was 8 inches high. Bed materials were almost uniform size having a medium diameter of 0.42 mm and a standard deviation of 1.27. Analytical solution was done using Tinny's theory, with some modifications. The result of the bed degradation obtained by computation agree reasonably with the measured data, except near the dam where the observed degradation was more than the computed one with a maximum difference of 35%. Critical shear stress sediment characteristic and roughness coefficient were also determined from the laboratory data. (Woodard-USGS)

W71-09149

MODEL STUDIES OF NAVIGATION IM-PROVEMENTS, COLUMBIA RIVER ESTUARY. REPORT I. HYDRAULIC AND SALINITY

REPORT I. HYDRAULIC AND SALINITY VERIFICATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Frank A. Herrmann, Jr.
Available from the National Technical Information Service as AD-720 545, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-735, Dec 1968 262 p. 1968. 262 p.

Descriptors: \*Break waters, \*Model studies, \*Estuaries, \*River flow, Salinity Tides, Sedimentation, Test procedures, Jetties, Columbia River. Identifiers: \*Hydraulic models, Test equipment.

The Columbia River estuary model was a combination fixed-bed and movable-bed model, constructed to scales of 1:500 horizontally and 1:100 vertically, and reproduced the lower 52 miles of the Columbia River and an adjoining portion of the Pacific Ocean. The model was equipped with the necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinity intrusion, freshwater inflow, shoaling distribution, and other significant prototype phenomena. The purpose of the model study was to determine op-timum plans for the rehabilitation of the stone jetthe effects of a proposed enlargement of the existing navigation channel from 35 by 500 ft to 40 by 600 ft, and to develop and evaluate various plans for the reduction. for the reduction of maintenance dredging costs throughout the model area. Model verification tests indicated that the model hydraulic and salinity regimens were in satisfactory agreement with those the prototype for comparable conditions. It therefore can be assumed that the model provided quantitative answers concerning the effects of the proposed plans on the hydraulic and salinity regimens of the estuary. (See also W71-09342 and W71-09343) W71-09341

MODEL STUDIES OF NAVIGATION IM-PROVEMENTS, COLUMBIA RIVER ESTUARY REPORT 2. ENTRANCE STUDIES, SECTION 1. FIXED-BED STUDIES OR SOUTH JETTY REHABILITATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Frank A. Herrmann, Jr., and Henry B. Simmons.

Available from the National Technical Information Service as AD-720 546, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-735, Aug 1966. 163 p.

Descriptors: \*Breakwaters, \*Model studies, \*Estuaries, \*Jetties, River flow, Tides, Salinity, Test procedures, Columbia River, Tides, Sedimen-

Identifiers: \*Hydraulic models, Damage control.

The existing comprehensive fixed-bed model of the Columbia River estuary was used to determine the need for rehabilitating all or part of the outer end of the existing south jetty. This jetty has seriously deteriorated during the past 25 years, and an extensive rehabilitation program has been undertaken. Model tests were conducted to determine the effects of various stages of repair of the outer 1900 ft of the jetty on the hydraulic, salinity, and shoaling characteristics of the entrance area. Tests results consist of tidal elevation measurements, current velocity measurements, salinity measurements, photographs of surface and bottom current patterns, and shoaling patterns. The results of the model tests indicate that rehabilitation of the existing outer end of the south jetty will not significantly benefit the hydraulic, salinity, or shoaling characteristics of the entrance area as a whole, although it is possible that some additional protection to vessel traffic from ocean wave action would be effected by the rehabilitation. The test results indicate further that shoaling of the entrance channel will

### **Group 8B—Hydraulics**

be significantly reduced, especially at the inner bar, if the seaward 1900 ft of the south jetty is allowed to degrade to an elevation of about -15 ft mllw. (See also W71-09341) W71-09342

MODEL STUDIES OF NAVIGATION IM-PROVEMENTS, COLUMBIA RIVER ESTUARY. REPORT 2. ENTRANCE STUDIES. SECTION 2. FIXED-BED STUDIES OF NORTH JETTY REHABILITATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Frank A. Herrman, Jr., and Henry B. Simmons. Available from the National Technical Information

Available from the National Technical Information Service as AD-720 547, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-735, Nov 1966, 157 p.

Descriptors: \*Breakwaters, \*Model studies, \*Estuaries, \*Riverflow, Jetties, Test procedures, Columbia River, Salinity, Tides, Sedimentation. Identifiers: \*Hydraulic models, Damage control.

The existing, comprehensive fixed-bed model of the Columbia River estuary was used to determine the need for rehabilitating all or part of the outer end of the existing north jetty. This jetty has seriously deteriorated during the past 25 years, and a rehabilitation program has been undertaken. Model tests were conducted to determine the effects of various stages of repair of the outer 1800 ft of the jetty on the hydraulic, salinity, and shoaling characteristics of the entrance area. Test results consist of tidal elevation measurements, current velocity measurements, salinity measurements, photographs of surface and bottom current patterns, and shoaling patterns. The results of the model tests indicate that complete rehabilitation of the outer end of the jetty will provide moderate benefits to the hydraulic, salinity, and shoaling characteristics of the entrance area as a whole when compared with results of tests with the outer 1400 ft of the jetty degraded to -15 ft mllw, simulating conditions which may obtain if that portion of the jetty is not rehabilitated. However, it is recom-mended that before the outer end of the jetty is repaired, more detailed movable-bed tests be performed to determine the optimum jetty condition. (See also W71-09341). W71-09343

INVESTIGATION OF IN-SHORE HARBOR, SITE X. REPORT 1. DESIGN FOR OPTIMUM WAVE CONDITIONS. HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station,
Vicksburg, Miss.

H. B. Wilson.

Available from the National Technical Information Service as AD-720 973, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-740, 77 p. 7 ref.

Descriptors: \*Breakwaters, \*Model studies, \*Harbors, \*Ocean waves.

Identifiers: \*Hydraulic models, South China Sea, Harbor models

The area for which the Site X harbor was proposed assumed a location in the South China Sea where an entrance channel leading into the harbor could be dredged inland approximately normal to a straight shoreline. The offshore hydrography was idealized in that the depth contours were assumed to be parallel to the shoreline and correspond to a bottom slope of 1:30. The entire inner-harbor area, approach channel, proposed protective breakwater system and wave absorbers, along with sufficient adjacent coastline and offshore hydrography necessary to the accurate simulation of storm-wave action, were reproduced in a 1:100-scale hydraulic model equipped with wave-generating and wave-height-measuring devices. The purpose of the model study was to determine the efficacy of the proposed breakwaters and companion in-harbor wave absorbers in providing adequate protection for T-1-Tanker and LST-1171 type craft berthed in the harbor during storm-wave action. It was concluded that (a) an arrowhead type of breakwater system or a parallel-jetty arrangement, with the breakwater arms so positioned as to provide a navigation entrance 420 ft wide, a 120-ft-wide, 24ft-deep dredged navigation channel and a 24-ft-deep dredged inner-harbor basin, in combination with the proposed wave-absorber systems, would provide excellent protection against severe storm waves for the types of boats that would make use of the inner harbor, (b) adequate inner-harbor protection against storm waves would also be realized, with either a parallel-jetty or arrowhead-type breakwater system, for a 530-ft-wide navigation entrance between the outer ends of the breakwaters or jetties and with a dredged navigation channel, 120-ft-wide with a depth of 35 ft, leading into a 35-ft-deep inner-harbor basin. (See also W71-09346) W71-09345

INVESTIGATION OF IN-SHORE HARBOR, SITE X. REPORT 2. DESIGNS OF RIPRAP COVER LAYERS. HYDRAULIC MODEL IN-VESTIGATION, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. R. A. Jackson.

Available from the National Technical Information Service as AD-720 982, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-740, Sept 1966. 43 p, 2 ref.

Descriptors: \*Breakwaters, \*Harbors, \*Model studies, \*Ocean waves, Riprap. Identifiers: \*Hydraulic models, South China Sea.

Two series of stability tests on riprap cover layers were conducted in a 2-ft-wide wave flume using a 1:15-scale model. In the first series, riprap cover layers on composite beach slopes of 1:30 and 1:8 were investigated. These slopes reproduced the natural beach slopes on each side of the entrance channel dredged from deep water to the in-shore harbor. In the second series of tests, riprap cover layers on a slope of 1:5 were investigated. These cover layers were for protection of the entrancechannel side slopes from the erosive action of waves. Also, the crown elevations of the various riprap sections were determined. Stable riprap designs were developed for all sections that required riprapping. Because the larger waves broke before reaching the area of the still-water level, the size riprap required to protect the 1:30 and 1:8 beach slopes was small. The size riprap required to protect the submerged side slopes of the dredged entrance channel was found to be a function of both wave height and water depth at the crest of the submerged channel slope. For a given wave height, side slope, and specific weight of rock, the required size of riprap increases as the water depth, measured at the crest of the slope, decreases. For similar riprap sections with an unsubmerged crest, the required size of riprap is primarily a function of wave height. (See also W71-09346)

DESIGN FOR OPTIMUM WAVE CONDITIONS, DANA POINT HARBOR, DANA POINT, CALIFORNIA. HYDRAULIC MODEL IN-VESTIGATION, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. Howard B. Wilson.

Available from the National Technical Information Service as AD-720 190, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-724, June 1966. 55 p, 9 ref.

Descriptors: \*Breakwaters, \*Harbors, \*Model studies, \*Shore protection, Ocean waves, Storms, Construction materials, California. Identifiers: \*Hydraulic models, Bathythermograph data, Water traffic, Patrol craft, Seacoast, \*Dana Point Harbor, Rubble mound breakwaters, \*Dana

The entire Dana Point area that will be enclosed by Dana Point Harbor and sufficient adjacent coast Dana Point Harbor and sufficient adjacent coast-line and offshore bathymetry to permit accurate simulation of storm-wave action were reproduced in a 1:100-scale hydraulic model equipped with wave-generating and wave-height-measuring devices. The purpose of the model study was to determine the effectiveness of the proposed break-water system and inner-harbor basin in providing protection from storm action for pleasure craft and protection from storm action for pleasure craft and fishing boats berthed within the harbor. It was concluded that the proposed breakwater system, which consists of a 5500-ft-long west breakwater and a companion 2250-ft-long east breakwater with a 600-ft-wide navigation entrance at the southeast corner of the harbor, will provide the degree of protection required for small boats to berth safely in the apprintly applied in the partially applied in the partial ap in the partially enclosed inner-harbor basin. Investigation of the wave-transmission problem, concerning the degree of wave energy that can reach the inner harbor through the interstices of the proposed rubble-mound breakwaters, showed that the wave energy transmitted to the inner basins of the harbor through the outer breakwater structures is not critical. Wave energy transmitted into the fairway by overtopping of the proposed west breakwater by near-maximum storm waves, which have a low frequency of occurrence, was found to cause conditions in the fairway that would be dangerous to small craft. However, it was determined that modification of the mole slope flanking the fairway to include a berm will reduce the wave-reflecting characteristics of this structure, and thereby reduce wave action in the fairway considerably during severe storms. W71-09347

FILLING AND EMPTYING SYSTEMS, LOWLIFT LOCKS, ARKANSAS RIVER PROJECT. HYDRAULIC MODEL INVESTIGATION,

JECT. HYPKAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Jackson H. Ables, Jr., and B. Boyd Marden. Available from the National Technical Information Service as AD-720 975, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-743, Nov 1966. 188 p.

Descriptors: \*Dams, \*Model studies, \*Locks, Flow, Drainage, Arkansas River, Culverts. Identifiers: \*Hydraulic models, Filling, Hydraulic systems, Culverts.

The low-lift locks on the Arkansas River will be 110 ft wide by 670 ft long (pintle to pintle) and will have normal lifts ranging from 14 to 30 ft. There are 15 low-lift locks at which conditions are similar enough that relatively little change in the design of the lock hydraulic system will be required at the different sites. Results of tests of the hydraulic system for these projects in a 1:25-scale model are presented in this report. Two satisfactory culvert intake manifolds were developed, a 6-port type 2 intake and an 8-port type 4 intake. The original design culvert outlet manifold which discharged into the lower lock approach performed satisfactorily. Tests of 74 sidewall port arrangements resulted in the development of five port arrangements using type A or D ports considered suitable for use at the Arkansas River low-lift projects. The type A ports are 2.54 ft wide by 3.50 ft high and the type D ports are 2.54 ft wide by 4.10 ft high. At lock 2 design conditions, 20-ft lift and 17-ft submergence (base test conditions in the model stop.) mergence (base test conditions in the model stuthe recommended arrangements permit the lock to be filled in 7.5 min or less with turbulence conditions in the lock chamber and maximum hawser stresses not exceeding 5 tons. The lock can be emptied in less time with lower hawser stresses. W71-09348

SPILLWAY AND NAVIGATION CONDITIONS, HOLT LOCK AND DAM, WARRIOR RIVER, ALABAMA. HYDRAULIC MODEL INVESTIGA-

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
E. S. Melsheimer, and T. E. Murphy.

Point (Calif).

Available from the National Technical Information Service as AD-720 979, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report No 2-745, Oct 1966. 72 p.

Descriptors: \*Dams, \*Model studies, \*Spillways, Hocks, Culverts, Flow navigation.
Identifiers: \*Hydraulic models, Hydraulic systems,
Alabama, Holt Dam, Warrior River.

The hydraulic model investigations reported herein were concerned with navigation conditions in the lock approaches, performance of the spillway, the feasibility of lock culvert intakes and outlets on the riverside of the riverward lock wall, and flows through the first and second construction stage diversion channels. Tests were conducted on two models: a 1:80-scale general model which reproduced 4800 ft of the approach channel, the spillway, the powerhouse, the navigation lock, and 4800 ft of the exit channel; and a 1:36-scale section model of one spillway gate bay and adjacent half bays. Navigation conditions in the upstream lock approach were excellent. Flows from the powerhouse created a strong eddy in the downstream lock approach. This eddy could not be eliminated by a feasible plan of excavation or a system of training walls. However, a rock dike installed in the river channel intercepted the crosscurrent and resulted in acceptable navigation conditions. The capacity of the spillway was not as great as had been computed. Model tests indicated reasonable weir and pier contraction discharge coefficients but excessive losses at the abutments and a submergence effect of the tailwater. The excessive losses at the abutments were reduced by modifications of the end piers. A stilling basin was not deemed necessary, and model tests were used to develop a toe curve which deflected the nappe away from the immediate toe of the spillway. The feasibility of the lock culverts' intake and discharge systems was verified. The adequacy of both the first and second construction stage diversion schemes was established. W71-09349

NAVIGATION CONDITIONS AT LOCK AND DAM NO 4, ARKANSAS RIVER. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

John J. Franco, and Cody D. McKellar.

Available from the National Technical Information
Service as AD-720 984, \$3.00 in paper copy, \$0.95
in microfiche. WES Technical Report No 2-746, Oct 1966, 84 p.

Descriptors: \*Dams, \*Locks, \*Model studies, \*Navigation, Inland waterways, River flow. Identifiers: \*Hydraulic models, River currents, Arkansas River, Rob Roy Bridge.

Lock and Dam No 4 will consist of a 110- by 600-ft Lock and Dam No 4 will consist of a 110-by social lock and a 1190-ft-long, gated, nonnavigable dam. A 1:120-scale, fixed-bed model, reproducing 5.2 miles of the Arkansas River, was used to: (a) demonstrate flow conditions in lock approaches and in vicinity of Rob Roy Bridge (1.3 miles above lock); (b) determine effect of various guard wall designs on forces affecting tows in upper lock approach; (c) determine optimum location of harbor and dock, and mooring facilities; (d) measure dis-tribution of different flows throughout the model; and (e) furnish information for use in developing modifications of the approaches and structures to improve navigation conditions. Tests were con-cerned with study of flow patterns, measurement of velocities in lock approaches, and behavior of a model tow on entering and leaving the locks and navigating through Rob Roy Bridge under flows ranging from 100,000 to 350,000 cfs. Test results indicated: (a) location of lock and dam with respect to Rob Roy Bridge was satisfactory; (b) lock upper guard wall (riverside) instead of a guide wall should be used to provide satisfactory navigation conditions. Port capacity of the guard wall should be sufficient to eliminate hazardous cross-currents; (c) harbor and dock facilities should be sufficiently far upstream of lock to eliminate their

effects on navigation approaching the lock; (d) navigation through existing Rob Roy Bridge swing span might be hazardous during high flows because of high velocities and limited bridge opening. Removal of a point along right bank at bridge would reduce velocities without affecting navigations of the property of the p tion conditions downstream of bridge; (e) naviga-tion conditions in lower approach should be satisfactory. W71-09350

FILLING AND EMPTYING SYSTEMS, MIL-LERS FERRY AND JONES BLUFF LOCKS, ALABAMA RIVER, ALABAMA. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Jackson H. Ables, Jr., and Marden B. Boyd.

Available from the National Technical Information Service as AD-720 192, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-718, Mar 1966, 116 p.

Descriptors: \*Dams, \*Model studies, \*Flow, Drainage, Test procedures, Alabama.

Identifiers: \*Hydraulic models, Hydraulic systems,

Filling and emptying systems for the 600- by 84-ft Millers Ferry (48-ft lift) and Jones Bluff (45-ft lift) Locks will comprise two intake ports in the river side of the upper gate block, 10-ft-square culverts in each wall, a lateral crossover culvert at the midpoint of the lock leading to four longitudinal floor culverts with side ports, and culvert outlets which empty riverward of the lock in the common outlet basin. Reverse-mounted tainter valves control flow in the system. The hydraulic system was tested in a 1:25-scale model. Original design intakes and outlets performed satisfactorily. The major portion of the study was devoted to developmental tests of a new type of filling system, the longitudinal floor culvert system. Two systems were developed, one to conform to site restrictions at the Millers Ferry project and a second for use at the Jones Bluff project where no space limitations are placed on the system. Pressures were satisfactory except just downstream from the filling valves; pressures recorded in these areas may result in cavitation. Admission of small controlled quantities of air just downstream of the valves should cushion the collapse of vapor pockets and minimize possible damage without adversely affecting performance of the system. With the adopted hydraulic system installed in the model, hawser stresses on 6and 12barge tows were well within the 5-ton limit during operations with normal heads and 14-ft submergence. The longitudinal floor culvert systems investigated exhibited several favorable characteristics which suggest that these systems may be used effectively in larger and higher-lift locks. However, much additional developmental work is needed prior to the use of such a system at projects with larger locks or significantly higher lifts. W71-09351

FILLING AND EMPTYING SYSTEM, CORDELL HULL NAVIGATION LOCK, CUMBERLAND RIVER, TENNESSEE. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Noel R. Oswalt, and Marden B. Boyd.

Available from the National Technical Information Service as AD-720 977, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-739, Sept 1966.89 p.

Descriptors: \*Dams, \*Model studies, \*Drainage.

\*Locks, Flow, Tennessee.
Identifiers: Hydraulic models, Filling, Hydraulic systems, Mechanical drawings, Cordell Hull Dam, Cumberland River.

Cordell Hull Lock will be 84 ft wide by 450 ft long and will have a normal lift of 59 ft with a maximum lift of 62 ft occurring about 5 percent of the time.

Model study (scale 1:25) of the filling and emptying system proposed for this lock was confined to the portion of the hydraulic system between the filling and emptying valves. Performance of the type 1 (original) multiport arrangement was, in general, satisfactory even though it was evident from test results that certain improvements could be made in the system. The lock chamber manifold includes three horizontal rows of seventy-two 8-in.diam ports resulting in an overall port area/culvert area ratio of 0.75 based on the culvert area at the valves. The manifold extends over 48 percent of the chamber length and is centered about 3.9 percent of the chamber length upstream from the midpoint of the chamber. The ports discharge into a 3-ft-wide by 6.5-ft-deep trench along the toe of the lock wall. With the proposed filling-emptying system the lock can be filled in 11.0 min (4-min valve) and emptied in 11.2 min (1.5-min valve) with acceptable buyers stores and turbulence. with acceptable hawser stresses and turbulence conditions in the chamber. Consideration of the performance of the system and construction schedules at the project resulted in its adoption for use at the Cordell Hull project. However, additional tests of the multiport system were conducted since this type of system was under consideration for use at another project. These tests resulted in several suggestions for improvements in the system. Port arrangements in which conventional sidewall ports discharged into a trench at the toe of the lock wall were also investigated, but their performance did not compare favorably with that of the better multiport arrangements. W71-09352

CULVERT PRESSURES, GREENUP LOCK, OHIO RIVER, KENTUCKY. HYDRAULIC PROTOTYPE TESTS,

Army Engineer Waterways Experiment Station,

Vicksburg, Miss.
Peter M. Smith, and Ronald A. Yates.

Available from the National Technical Information Service as AD-720 544, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-734, July 1966. 45 p.

Descriptors: \*Dams, \*Model studies, \*Locks, Test procedures, Drainage, Hydrostatic pressure, Kentucky, Culverts.

Identifiers: \*Hydraulic models, Filling, Test facilities, Greenup Dam.

Prototype tests were conducted at Greenup Lock to investigate pressures in the filling and emptying systems of the main lock and water-surface elevations in the lock chamber. Continuous measurements were made with valve opening and closing periods of 4 and 8 min for conditions of two-culvert (normal) operation, single-culvert operation, and steady flow. The steady-flow tests yielded data concerning head loss coefficients through the lock manifolds and laterals. Discharge coefficients for two-culvert operation were also obtained. These data were compared with results obtained from the hydraulic model study. Dissimilarities between model and prototype results are thought to be largely due to dissimilarities between model and prototype designs. However the test results are believed to substantiate the validity of the model. W71-09353

DROP STRUCTURES FOR WALNUT CREEK PROJECT, WALNUT CREEK, CALIFORNIA. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

G. A. Pickering.

Available from the National Technical Information Service as AD-720 187, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-730, June 1966. 57 p, 3 ref.

Descriptors: \*Dams, \*Model studies, \*Stilling basins, \*Flow, Riprap, Test procedures. Identifiers: \*Hydraulic models, Walnut Creek (Calif).

## Group 8B-Hydraulics

Walnut Creek project will provide for enlargement and rectification of the existing channels of Walnut, Lower San Ramon, and Las Trampas Creeks. Three grade control structures and one energy dissipating structure will be used to reduce velocities and dissipate excessive energy from flood flows. Model investigations were conducted on 1:20-scale models of drop structures 2 and 3. Tests were concerned with determining the optimum size and configuration of the stilling basins for these structures, the stability of the riprap downstream from the stilling basins, and the adequacy of the inlet transition upstream from dropstructure 2. Tests revealed that flow conditions produced by the original design stilling basins of both structures were unsatisfactory. Several modifications to drop structure 2 were tested in an effort to reduce the high velocities and surface waves that occurred in the exit channel with the original design. A stilling basin that resulted in satisfactory flow conditions with the design discharge was developed. The riprap requirements in the exit channel downstream from the stilling basin were determined. Flow conditions through the inlet transition upstream from drop structure 2 were satisfactory for all discharges tested. W71-09354

REDUCTION OF SHOALING IN CHARLESTON HARBOR AND NAVIGATION IMPROVEMENT
OF COOPER RIVER, SOUTH CAROLINA
HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station,

Vicksburg, Miss.
William H. Bobb, and Henry B. Simmons

Available from the National Technical Information Service as AD-720 193, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-733, July 1966, 166 p.

Descriptors: \*Harbors, \*Model studies, \*Shoals, \*Inland waterways, Salinity, Test procedures, Sedimentation, Tides, South Carolina.

Identifiers: \*Hydraulic models, River currents, Cooper River, Wando River, Charleston Harbor, Cooper River, South Carolina.

The existing comprehensive fixed-bed model of the Charleston Harbor system was used to conduct several special-purpose studies. These studies involved a proposed silt trap in Wando River, salinity investigations, a proposed spoil area dike, a scheme to redivert powerhouse discharge from Cooper River into Wando River, intermittent powerhouse operation to meet peak demands, and a proposed extension of the existing navigation channel in Cooper River. In general, model tests were conducted to determine the effects of the several proposals on tides, currents, and salinities throughout the estuary, and test results consist primarily of measurements of tide heights, current velocities, salinities, time-exposure photographs of surface current patterns, graphic illustrations of dye dispersion, and analyses to determine flow predominance. W71-09355

SPILLWAY AND OUTLET WORKS, SHEL-BYVILLE DAM, KASKASKIA RIVER, IL-LINOIS. HYDRAULIC MODEL INVESTIGA-

Army Engineer Waterways Experiment Station,

Don R. Bucci, and John L. Grace, Jr.

Available from the National Technical Information Service as AD-720 186, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-719, June 1966. 131 p.

Descriptors: \*Dams, \*Model studies, \*Spillways, \*Stilling basins, Outlet works, Test procedures, Flow, Construction materials, Hydrostatic pressure, Illinois.
Identifiers: \*Hydraulic models, Shelbyville Dam,

Kaskaskia River (III).

Tests were conducted on a 1:40-scale model reproducing the spillway for Shelbyville Dam, a combination concrete and earth structure rising 108 ft above the bed of the Kaskaskia River. The spillway consists of an ogee crest controlled by three tainter gates 45.33 ft wide and 36.92 ft high; a three tainter gates 43.35 if white and 30.92 it migh, a 156-ft-2ide, 206-ft-long chute sloped 1 on 4; and a conventional hydraulic jump type stilling basin. The design flood, 162,500 cfs, will be passed at pool elevation 638.2 by combined operation: pool elevation 638.2 by combined operation: 157,500 cfs over the spillway and 5000 cfs through two 11-ft-high by 5.5-ft-wide sluices through the spillway section beneath the piers. Flow conditions in the approach, discharge characteristics of the spillway, hydrostatic pressures on the ogce weir crest, performance of the conventional stilling basin, and the height of the training walls were investigated. The limits of two exit channel protection plans involving the use of various sizes and gradations of stone and concrete paving were developed with and without berms behind the training walls. Surging at the abutments was minimized and weir capacity was increased by the use of rock dikes near the abutments. The spillway rating curve determined by the model was inadequate, yet reasonably compatible with the theoretical rating curve; and the combined capacity of the adopted spillway and sluices was adequate. Heads greater than the design head created negative pressures on the weir crest as expected; however, cavitation was not indicated. Satisfactory energy dissipation was obtained with a 125-ft-long horizontal stilling basin at the elevation dictated by foundation conditions (513.0) surmounted by two rows of 10-ft-high baffle piers and terminated by a 5-ft-high vertical-faced end sill.

The model indicated that the height of the stilling basin training walls could be reduced 5 ft.

NAVIGATION CONDITIONS AT BELLEVILLE LOCKS AND DAM, OHIO RIVER, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

John J. Franco, and Louis J. Shows.

Available from the National Technical Information Service as AD-720 549, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-738, Sept

Descriptors: \*Dams, \*Model studies, \*Flow, \*River flow, Navigation, Sites, Test procedures, West Virginia, Ohio, Locks, Canals.

Identifiers: \*Hydraulic models, Site selection, Belleville Dam, Ohio River.

Belleville Locks and Dam, designed to maintain during low flows a single upper pool extending up-stream 41.7 miles, will replace Locks and Dams Nos. 18, 19, and 20 of the present Ohio River navigation system. The dam will consist of a nonnavigable gated structure 892 ft long with a damming height of 32 ft, and a 265-ft-long, fixedcrest weir connecting the gated spillway with the left bank. The locks, on the right bank, are to be of the high-lift type (ultimate 22 ft) consisting of two parallel chambers having clear dimensions of 110 by 1200 ft and 110 by 600 ft. An undistorted 1:120-scale, fixed-bed model, reproducing approximately 3.1 miles of the Ohio River and the lock and dam structures, was used to study the adequacy of the proposed design, to determine the best location for the locks under various flow conditions, and to develop measures to overcome or minimize the effects of any adverse conditions noted. The results of the investigation indicated that, because of the alignment of currents, the locks and dam should be shifted to the right as far as practicable to improve navigation conditions in the upper lock approach and flow distribution through the dam. The swellhead through the structures during medium flows could be reduced by increasing the number of dam gates from seven to eight. Velocities in the upper approach will tend to be high, but can be reduced by the use of submerged dikes. W71-09360

STEADY-FLOW STABILITY TESTS OF NAVIGATION OPENING STRUCTURES, HILO HARBOR, TSUNAMI BARRIER, HILO, HARBOR, TSUNAMI BARRIER, HILO, HAWAII, HYDRAULIC MODEL INVESTIGA-

TION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Noel R. Oswalt, and Marden B. Boyd.

Available from the National Technical Information Service as AD-720 981, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-742, Oct 1966. 17 p, 16 photos, 14 plates.

Descriptors: \*Breakwaters, \*Model studies, \*Harbors, Ocean waves, Hawaii, Tsunamis.
Identifiers: \*Hydraulic models, Hilo Harbor (Hawaii).

Steady-flow tests of navigation opening structures in the Hilo Harbor tsunami barrier were conducted to determine the effect of tsunami-induced highvelocity currents through the navigation opening on stability of the barrier heads. Tests were conducted in a 1:60-scale model which reproduced one-half of the navigation opening and a 1:72-scale model which reproduced the full opening. Steady flow through the opening with a head differential of 28 ft across the barrier was the basic test flow, representing the peak flow condition caused by the design tsunami. Tests were designed to determine the cover-stone size required on the barrier heads for stability under this steady-flow condition and also to investigate methods for providing toe protection for barrier heads constructed on sand. Results of the steady-flow tests were to be correlated with results of model tests concerned with wave action and with other factors to develop the optimum design of the tsunami barrier. Steady-flow test results indicated that the barrier head coverstone size needed for stability under steady flow was considerably smaller than that needed for stability against wave action. Test results also showed that the only reliable method of obtaining stable barrier heads was to construct them on a rock foundation. If conditions made this impractical, a protective blanket of stone covering the entire channel bottom through the navigation opening was recom-mended to protect the toe of the barrier heads. Additional stone placed around the toe of the barrier to 'armor' the toe as sand scoured away was not recommended unless the depth of sand at the site was shallow and unless repair and maintenance operations could be performed after each tsunami until the currents removed all sand, leaving the barrier heads resting on rock. W71-09361

## 8C. Hydraulic Machinery

TESTING AND EVALUATION OF OIL SPILL RECOVERY EQUIPMENT. Main Port Authority, Portland.

For primary bibliographic entry see Field 05G. W71-08942

Lake Powell Quality Studies for the Navajo Plant, Bechtel Inc., San Francisco, Calif; and Arizona State Univ., Tempe.

For primary bibliographic entry see Field 05C. W71-09051

TURBINE-DISCHARGE MEASUREMENTS BY CABLE-SUSPENDED CURRENT METERS, Corps of Engineers, Omaha, Nebr. Missouri River

G. N. Lathrop, and R. A. Singleton.
Paper, Corps of Engineers, Missouri River Division, Reservoir Control Center, Omaha, Nebr, Dec 1970. 32 p, 23 fig, 1 ref, 2 append.

Descriptors: \*Discharge measurement, \*Hydraulic turbines, \*Current meters, \*Water measurement, Discharge (Water), Flow measurement, Flow, Flow around objects, Errors, Turbulent flow, Analysis, Instrumentation, Electronic equipment.

#### Soil Mechanics—Group 8D

Model tests, Laboratory tests, Reproducibility, Computer applications, Accuracy, Reliability.

A method of using cable-suspended current meters for measuring discharges in the intake passages of hydraulic turbines was developed by the Corps of Engineers. The procedure is used in plants with intake passages changing cross section leading directly into the scroll case without a penstock. The cable suspension system reduces distortion of the flow because the slender cables on which the current meters are mounted are too far apart to cause a cumulative effect. The apparatus used and the methods of making measurements are described and compared with rigid-frame-type installations and measurements. Results obtained from the sure-suspended method of turbine-discharge measurement have been successful with an accuracy of measurement within 2%, meeting all requirements of most acceptable codes. (USBR) W71-09052 cable-suspended method of turbine-discharge mea-

# APPLICATION OF DIMENSIONAL ANALYSIS TO FLASHOVER CHARACTERISTICS OF POL-LUTED INSULATORS,

Electricity Corp., Cairo (Egypt). F. A. M. Ritk. Proceeding Institution of Electrical Engineers (Engl), Vol 117, No 12, p 2257-2260, Dec 1970. 4

Descriptors: \*Flashover, Contamination, \*Electrical insulators, Field investigations, Direct current, Alternating current, Bibliographies, Air pollution, \*Dimensional analysis, Laboratory tests, Transmission lines, \*Electric arcs, Electric fields, Leakage current, Performance, Foreign research, Characteristics, Investigations.
Identifiers: United Arab Republic, Contaminants.

The method of dimensional analysis is applied to determine flashover characteristics of polluted in-sulators. Expressions deduced for flashover voltsulators. Expressions deduced for flashover voltages in a d-c circuit under simplified conditions agree with previous analytical findings. The work is extended to flashover characteristics in a-c systems where the dynamic properties of arcs are introduced. The same functional dependence of flashover voltages on pollution and insulator characteristics prevails as for d-c conditions, although magnitudes of the flashover voltages may be different in the 2 cases. An expression for the be different in the 2 cases. An expression for the velocity of arc propagation along polluted insulator surfaces is deduced with due consideration of insulator, layer, and circuit parameters. Of special interest are the dependence of the ultimate arc velocity on the short-circuit current of the test circuit and the expression for minimum voltage necessary to start arc motion. Whenever possible, the analyses are compared with previous field and laboratory experiences. (USBR)

## RADIOISOTOPES AND TURBINE FLOW MEA-

SUREMENTS, Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 07B. W71-09066

# EFFECT OF HYDROTURBINE OPERATING CONDITIONS ON THE INTENSITY OF CAVITATION EROSION, Leningrad Metal Works (USSR).

N. I. Pylaev, A. A. Sotnikov, and A. M. Livshits. Bur Reclam Transl 846, Jan, 1971. 23 p, 5 fig, 3 ref, 2 append. Energomashinostr, No 1, p 30-33,

Descriptors: \*Hydraulic turbines, Model tests, Francis turbines, High head, \*Fluid flow, Kaplan rrancis turbines, High head, \*Fluid flow, Kaplan turbines, Cavitation control, Materials tests, \*Cavitation, Cavities, Stainless steel, Accelerated erosion, \*Cavitation index, \*Turbine blades, Velocity, Laboratory tests, Submergence, Turbine efficiency, Vortices, Pitting, Foreign design practices, Damages. Identifiers: USSR, \*Cavitation parameters, Bak-sansk Powerplant, USSR, Stroboscopic lighting, Bratsk Powerplant, USSR.

Results of experiments on laboratory test stands and prototype turbines show that operating conditions play a large part in the development of cavita-tion erosion. Stroboscopic observation of flow in models shows that vapor cavities form on blades of turbines before the onset of the disruption of efficiency. Two types of cavitation are discussed: one type forms from separate vapor bubbles which join into a bubble of significant size, and the other forms from pulsating vapor cavities varying in frequency. The use of cavitation-resistant stainless steel did not eliminate cavitation damage in many cases. In test models, the method of accelerated erosion was used to simplify the determination of damage. The cited measures for selected operating conditions, unit submergence, and blade design are recommended to meet the requirements of cavita-tion-free operation, and will not necessarily lead to a decrease in turbine efficiency. Laboratory tests and field observations were conducted on Kaplan and Francis runner blades, including Bratsk and the Krasnoiarsk prototype installed at Baksansk Krasnoiarsk prototype in Hydropowerplant. (USBR) W71-09070

## **8D. Soil Mechanics**

## THE ENGINEERING PROPERTIES OF MINE

TAILINGS,
Bureau of Mines, Spokane, Wash.
For primary bibliographic entry see Field 08G.
W71-09053

## SAFETY FACTORS IN SOIL MECHANICS,

Nova Scotia Technical Coll., Halifax. G. G. Meyerhof.

Canadian Geotechnical Journal, Vol 7, No 4, p 349-355, Nov 1970. 7 p, 2 fig, 2 tab, 27 ref.

Descriptors: \*Safety factors, \*Soil mechanics, Probability, Stability analysis, \*Earthworks, Earth dams, \*Foundations, Variability, Retaining walls, Soil properties, Risks, Loads (Forces), Bibliographies, Failure (Mechanics), Safety, Sliding resistance, Foreign research. Identifiers: Canada.

The safety margin in earthwork and foundation engineering is considered in relation to soil exploration and tests, analysis of stability under applied loads, and construction and operation of the structure during service life. Customary overall and suggested partial safety factors used in stability analyses are governed mainly by the variability and uncertainty of assessment of soil resistance, the variability of applied loads, approximations in stability analyses, and the seriousness of a failure. On the basis of probability concepts of safety, the conventional overall safety factors used in earthwork and foundation engineering analyses are related to approximate probabilities of stability failure and to a range of overall coefficients of variation. Safety analysis of earthworks indicates that customary overall safety factors for large earth-retaining structures and foundations are fairly adequate, and that unless careful performance observations are made during and after construction, earth dams should be designed for a minimum overall safety factor of about 1.7 (USBR) W71-09061

#### STUDIES OF INTER-PARTICLE CHARACTERISTICS, VOID

Geoffrey Lees. Quarterly Journal of Engineering, Vol 2, No 4, p 287-299, May 27, 1970. 13 p, 4 fig, 3 plate, 4 tab, 18 ref, append.

Descriptors: \*Pores, \*Porous media, \*Voids, \*Interstices, Particle shape, Particle size, Aggregates, A method is described for studying characteristics of the voids contained within a mass of aggregate particles. Measurements were made on void cells dissected from single size aggregate systems of a variety of particle shapes in dense and loose packings. The measurements refer to the critical ratio of occupation and the critical ratio of entrance. From these measurements occupation size distribution curves and entrance size distribution curves can be drawn, analogous to particle size distribution curves. The results may be applied to the problem of the design of aggregate gradings to minimum or controlled void content, using premixing or filtration techniques, and to the related problem of segregation of mixed aggregates. (Knapp-USGS) W71-09082

# CONSOLIDATION CHARACTERISTICS OF SOME PLEISTOCENE PERIGLACIAL METASTABLE SOILS OF EAST KENT,

Imperial Coll. of Science and Techology, London (England). Dept. of Geology. For primary bibliographic entry see Field 02G. W71-09140

# SOIL-CEMENT SEEPAGE TEST SECTION LUBBOCK REGULATING RESERVOIR CANADIAN RIVER PROJECT, TEXAS,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

Glenn DeGroot.

Available from the National Technical Information Service as PB-198 136, \$3.00 in paper copy, \$0.95 in microfiche. Bur Reclam Rep REC-ERC-71-13, Feb 1971. 43 p, 40 fig, 4 tab, 2 ref, append.

Descriptors: \*Soil cement, \*Seepage, \*Permeability, Cracks, Reservoirs, Hydraulic gradient, Texas,

Reservoir leakage. Identifiers: \*Field tests, Thermal expansion, \*Permeability tests, Seepage losses, Canadian River Project (Tex), Lubbock Regulating Rsyr

A large-scale seepage test was performed on sections of soil-cement facing at Lubbock Regulating Reservoir in Texas. Two collection systems each covering about 1200 sq ft were built into the earth lining before the facing was constructed. Each col-lection system consisted of a butyl rubber sheet and sand blanket with a drainage pipe to collect the water and take it to a measurement tank. Seepage rates at unit gradient varied from 0.15 cu ft/sq ft/day at the beginning of the test to 0.002 cu ft/sq ft/day during the warmer months in 1968 to 1970. Rates increased to about 0.04 cu ft/sq ft/day during the colder months. Possible reasons for the decrease in seepage rates during the warmer months are: (1) closing of the shrinkage cracks; (2) algal growth in the cracks; and (3) temperature variation in the facing. A laboratory permeability test showed a considerably lower coefficient of permeability, indicating the most of the seepage in he test section was occurring along the cracks W71-09266

## MEASUREMENTS OF THE ENGINEERING PROPERTIES OF MARINE SEDIMENTS,

Naval Academy, Annapolis, Md. Dept. of Ocean Engineering. For primary bibliographic entry see Field 02J. W71-09291

#### THE SEAFLOOR EXCAVATOR, VOLUME IV. APPENDICES,

Northrop Corp., Anaheim, Calif. Electro-Mechani-

Cal Div.
C. P. Buckley, F. S. Coxe, and O. Shev.
Available from the National Technical Information
Service as AD-720 344, \$3.00 in paper copy, \$0.95
in microfiche. Naval Civil Engineering Laboratory Report CR-71.003, Dec 1970.

Descriptors: \*Beds under water, \*Oceans, \*Earth-handling equipment, Structural properties, Soil mechanics, Mathematical models, \*Dredging.

## **Group 8D—Soil Mechanics**

Identifiers: \*Ocean bottom, Underwater vehicles, Deep submergence, Removal, Underwater equipment, Environmental tests, \*Seafloor excavators, Underwater excavation, Underwater construction.

The system definition and analysis process through which a deep-ocean Seafloor Excavator is developed is described. Eight concepts are initially formulated and studied, with the three most practical being further developed. A comprehensive system and cost analysis of the three selected concepts is performed to determine the single, most effective concept. The preliminary design and the design specifications for this concept are developed. The resulting design is of a wide-tracked, remotely operated submersible vehicle equipped with a revolving, extendable (jackknife) dredging arm capable of performing earthmoving, excavating dredging tasks in waters as deep as 6000 feet. This report is comprised of four volumes: Volume I contains the summary, Volume II contains the preliminary design and specifications, Volume III contains the concept definition and system analysis studies conducted to establish the preliminary design requirements, and Volume IV contains supporting and supplemental data developed during the course of this program. W71-09358

## 8E. Rock Mechanics and Geology

## DEFORMATION OF ROCK FOUNDATIONS OF HIGH DAMS AFTER FILLING THE RESER-VOIRS.

R. R. Tizdel.

Hydrotechnical Construction, No 6, p 512-519, June 1970. 8 p, 7 fig, 13 ref.

Descriptors: Dams, \*Concrete dams, Rock foundations, \*Dam foundations, \*Deformation, Loads (Forces), Dam design, Large structures, Dam failure, Reservoir storage, Cracking, Cutoffs, Stress, Strain, Reservoirs, Settlement (Structural), Foreign research. Identifiers: USSR.

Deep reservoirs formed by high dams and storing large amounts of water cause deformations in the rock masses making up the bottom and sides of the basins. The deformations, which depend on the water load and on the dimensions of the surfaces over which the load is distributed, alter the stress in the rocks to a considerable depth. The deformations extend beyond the perimeter of the reservoirs, forming broad depressions. Under these conditions, the dam is situated on the edge of the depression thus formed, with the foundation sloping toward the upper pool. In the case of high concrete dams, this may result in tensile stresses in the base in contact with the rock and in the section of the foundation near the contact, which may cause partial destruction of the contact, opening of cracks in the foundation, and fracture of the cutoff. Several examples of the effect of the weight of reservoir water on the deformation of dam founda-tions are discussed. (USBR) W71-09060

#### UNDERGROUND ROCK STRUCTURES CHAL-LENGE THE ENGINEER,

Leeds, Hill and Jewett, Inc., San Francisco, Calif. T. A. Lang.

Paper American Society of Civil Engineers National Water Resources Engineers, Phoenix, Ariz, Jan 1971. 20 p, 3 fig, 5 ref.

Descriptors: Rock excavation, \*Rock foundations, Rock mechanics, \*Rock properties, \*Rock tests, Underground powerplants, Finite element method, Tunnel construction, \*Tunnel design, Foundations, In situ tests, In situ rock, Foundation investigations, Laboratory tests, Mines, Computer applications,

Elastic theory.
Identifiers: Bureau of Mines, Bureau of reclamation, Malpasset Dam, France.

Rock mechanics and engineering for rock construction have come a long way from being a qualitative art, and the design and construction of rock structures such as large excavations--either surface or underground--present a real challenge to the engineer. Techniques for investigating and determining within acceptable tolerances the rock conditions at a site are available, and reasonable analytical procedures have been developed. The engineer must correlate and meld the techniques and analytical procedures so that designs prepared for major engineering structures will ensure permanent stability and adequacy under specified conditions of usage. (USBR) W71-09065

#### 8F. Concrete

#### STRENGTH VS STRUCTURE: A STUDY FOR HYDRAULIC CEMENTS.

HYDRAULIC CEMENTS, Carnegie-Mellon Univ., Pittsburgh, Pa. E. M. Krokosky. Materials and Structures, Vol 3, No 17, p 313-323, Sept-Oct 1970. 11 p, 19 fig, 1 tab, 21 ref.

Descriptors: \*Molecular structure, \*Concretes, Cements, Theory, Voids, Compressive strength, Bonding strength, \*Concrete technology, Silicates, Tensile strength, Strength, \*Electron microscopy, Capillarity, Porosity, \*Portland cements, Water content, Water-Cement ratio, Bibliographies. Identifiers: Hydraulic cement, Cement chemistry, Cement hydration, Cement paste.

A review of the present state-of-the-art in structure versus strength determinations for hydraulic cements is undertaken. Morphological and mechanical factors are discussed. New electron micrograph studies of the hydrated material at 800 kv are presented. Evidence shows that hydrated portland cement is potentially a very strong material. All data suggest that primary bond exists between the aggregations of hydrated material, but the existence of primary bonds is not consistent with the structure of hydrated material as presented in the literature. By using 1000-kv electron microscopes equipment, substantial microscan breakthroughs will be made in the structure observation field. The mechanical testing field seems adequate in most respects. If the hydrated system consists primarily of strong primary bonds, some innovating thinking must be done to explain the nature of the strength of interactive bonds that could develop when these masses of hydrating material interact and interlock. (USBR) W71-09063

## CONTRIBUTION TO THE DETERMINATION OF THE SAFETY COEFFICIENT OF OF THE CONCRETE.

J. F. Orth.

Transl from French Bur Reclam Transl 725, Feb, 1971. 17 p, 9 fig, 18 ref. Schweizer Bauzeitung, Vol 88, No 43, p 965-970, Oct, 1970.

Descriptors: Concretes, Concrete properties, \*Concrete tests, \*Safety factors, \*Concrete technology, Coefficients, Design, Criteria, Crushing, Compression tests, Structural behavior, Dams, Stress, Strain, Laboratory tests, Foreign research, Bibliographies

Identifiers: \*Microfissuration, Breaking strength.

The engineer responsible for designing a structure is faced with the dilemma of reconciling the economy and safety of the structure so that it may be economically profitable and at the same time satisfy the strictest stability guarantees. Nothing must be neglected to ensure the greatest possible safety in the design. Questions arise as to whether traditional concrete compression and tension tests are sufficient and still guarantee the allowed degree of safety, and whether stresses less than those occurring at the breaking point cause a predislocation of the most strained parts. R Peltier and H Ruesch observed that concrete cannot be strained without damage beyond a certain stress. This stress is smaller than the breaking point stress obtained by traditional tests. Therefore, the safety of a large concrete structure should not be evaluated on the basis of traditional tests but rather the strength corresponding to the microfissuration threshold. When the safety coefficient based on the microfis-suration threshold is analyzed in comparison with the traditional coefficient, it is undeniable that the microfissuration threshold is based on superior experimental notions; the safety margin is narrower, but more realistic. (USBR)

## CONCRETE-POLYMER MATERIALS--THIRD TOPICAL REPORT, Bureau of Reclamation, Denver, Colo.

J. T. Dikeou.

Bureau of Reclamation Report REC-ERC-71-6 and Brookhaven National Laboratory Report BNL 50275 (T-602), Jan 1971. 107 p, 49 fig, 52 tab, 10

Descriptors: Concrete mixes, Concrete pipes, Concrete tests, \*Concrete technology, Impregnation, Research and development, Durability, \*Polymer concretes, Materials engineering, Construction materials, Desalination plants, Composite materials, Polymers, Monomers, Concretes, Structural concrete, Concrete properties, Concrete

Identifiers: \*Concrete-polymer materials, Concrete

Investigations of concrete-polymer materials as of June 1970 by a joint program of the Bureau of Reclamation, Brookhaven National Laboratory, Atomic Energy Commission, and Office of Saline Water are reported. Three materials being investigated are: (1) polymer-impregnated concrete (PIC - precast portland cement concrete im-pregnated by a monomer system which is subsequently polymerized in situ); (2) polymer-cement concrete (PCC - monomer is added during mixing of portland cement, water, and aggregate, followed by polymerization); and (3) polymer-concrete (PC - a composite formed by polymerizing a monomer and aggregate mixture). Investiga-tions indicate that the most successful concretepolymer material for construction is PIC, but present studies are including PC and PCC because of potential applications if feasible fabrication methods can be developed. Compared to conventional concrete, PIC shows impressive improvements in strength and durability. Tests show that PIC made with ordinary concrete has essentially the same properties as PIC made with a more expensive high-strength concrete. Applications for PIC being investigated are desalting plants, draintile, culvert and sewer pipe, beams and wall panels in housing, bridge decks, roads, luminaries, and un-derwater structures. (USBR) W71-09072

#### 8G. Materials

## THE ENGINEERING PROPERTIES OF MINE TAILINGS, Bureau of Mines, Spokane, Wash.

H. C. Pettibone, and C. D. Kealy.

Paper, American Society of Civil Engineers, National Water Resources Engineering Phoenix, Ariz, Jan 1971. 27 p, 16 fig, 6 tab, 10 ref, append.

Descriptors: Mine wastes, \*Construction materials. Highways, Physical properties, Earth dams, Environmental effects, Workability, Embankments, Gradation, Pervious soils, Cohesionless soils, Shear strength, Relative density, Stress-strain curves, Soil properties, Earth materials, Soil investigations, Soil mechanics, \*Properties, Materials engineering. Identifiers: \*Tailings.

Because of more and more emphasis on the quality of our environment, consideration of using waste materials such as mine tailings instead of creating new borrow pits for construction of highways and earth dams is becoming imperative. Some important engineering properties of mine tailings related to using the material for construction are presented. Mine tailings are manmade materials and have more uniform characteristics than most natural deposits. The desired gradation of materials from tailings can be obtained by using hydraulic cyclones or by selective excavation from tailings ponds. Mine tailings contain more minus No. 200 particles than might be expected for a good construction material; however, because of the particle shape and lack of colloidal particles, the material can contain more fines than normal and still be free draining and easily workable. Most mine tailings are cohesionless, compact easily, and have good shear strength. Sources of tailings can be found within economic haul distance of many construction sites. An example showing that mine tailings have been used successfully for a highway embankment, and a hypothetical case showing that tailings could be used to construct earth dams are presented. (USBR) W71-09053

#### FRP: CORROSION'S LATEST ENEMY.

H. R. Clauser.

Iron Age, Vol 206, No 16, p 81-88, Oct 1970. 8 p, 6 fig, 2 tab.

Descriptors: Corrosion resistance, Electronic equipment, Nylon, Boats, Thermoplastic resins, \*Reinforced plastics, Tensile strength, Mechanical properties, \*Reinforced plastic pipe, Research and development, \*Pipes, \*Plastics, Epoxy resins, \*Glass fibers, Electrical properties, Polyvinyl alcohol, \*Glass reinforced plastics, Dies, Aircraft, Polyester resins.

Identifiers: Fiberglass plastic pipes, Automobile in-

The use of fiber reinforced plastics (FRP) will increase at a faster pace than any other engineering material. Over the 3-year period, 1966-69, FRP output jumped an average of 27% per year, bringing the total value of molded FRP products up to about \$650 million in 1969. Reasons for the past production boom in FRP are many, including: (1) extremely versatile composites, (2) lightweight with relatively high strength-to-weight ratios, and (3) excellent corrosion resistance. In addition, FRP can be economically formed into virtually any shape and size part. Altogether, about 35,000 different parts are being made in reinforced plastics.

Presently, 22% of the total FRP production goes to the automobile industry; by 1975, use by this industry is expected to triple. Growth has been spectacular in the marine field; FRP now dominates construction of hulls from 14 to 50 ft in length. In commercial and private aircraft fields, fiber reinforced plastics are making steady gains. Pipe, probably the fastest growing segment of the market, is produced by continuous machine processes, and the resin and reinforcement can be tailored to meet specific service conditions. The applications of reinforced plastics are definitely in areas traditionally held by metals. (USBR) W71-09057

#### 8H. Rapid Excavation

THE TEST BORING OF WOHLMEYER TYPE 4.0 M DIAMETER MACHINE (TBM-840), TUNNEL BORING M. Muta, and S. Fujimoto.

IHI Engineering Review, Vol 3, No 5, p 84-90, Sept 1970. 7 p, 12 fig, 1 tab.

Descriptors: \*Boring machines, \*Field tests, Test procedures, Tunnels, Rock excavation, Tunnel construction, Tunneling, Specifications, Curves, \*Tunneling machines, Construction equipment, Performance, Construction methods, Boring. Tests of a Wohlmeyer Boring Machine (TBM-840) designed to bore a 4-m-dia investigation tunnel through andesite were made to determine the capabilities of the machine and to develop methods for boring a double tunnel, S-shaped siding. Tests were conducted in hard, abrasive rhyolite. Specifications of the machine, rock properties and geology at the test site, and test procedures are presented. The first test was to bore a straight tunnel 4 m in diameter and 50 m long while measuring boring rate, cutter power, drum torque, and cutting thrust. Average speed of the boring was 0.55 m per hr, considered satisfactory in hard rhyolite. The second test was to bore a double tunnel, S-shaped siding with a radius of curvature of 150 m. The double section was advanced by boring two 4-mdia overlapping tunnels with an eccentricity of 2 m. The boring machine could be steered nearly in accordance with the planned line. Conclusions are: (1) boring of double tunnels with the machine will be performed according to methods established in the tests; and (2) correcting yaw in straight boring and maintaining alignment for a curved tunnel axis can be attained easily. (USBR)

#### EXPERIMENTS IN ROCK CUTTING BY IM-PACT METHODS.

Marwin Mining Tools Ltd., Rothley (England).

Tunnels Tunnelling, Vol 2, No 6, p 359-365, Nov-Dec 1970. 6 p, 17 fig, 2 tab, 2 ref.

Descriptors: \*Rock excavation, Rocks, Cutting, \*Impact, Grooves, Test procedures, Excavation, Methodology, Rapid excavation, Laboratory tests, Research and development, Tunneling, Excavators, Foreign research. Identifiers: \*Cutters.

A test program to evaluate a method of cutting rock using a system of rigid tungsten carbide tipped flails called tines that cut by impact with the rock surface is described. Each tine is suspended freely on a steel pin. The pins are mounted on the periphery of a drum. By revolving the drum at high speed, each tine is flung outward to lie radial to the drum center. When the drum is moved toward the surface to be cut, each tine strikes the surface in turn. Concrete blocks made from one mix were cut to evaluate the effects of tine impact, depth of cut, direction or rotation, and power requirements for different tip shapes. Conclusions are: (1) moving the tine from the cut to the free surface is the preferred direction of rotation; (2) certain minimum tine velocity is required to obtain maximum-material removal; (3) cutting deep slots requires more energy than cutting shallow grooves; (4) tines cut effectively even with a cutting edge radius of 0.25 in.; (5) complete cutting of concrete is obtained with a tine spacing up to twice the tine width; and (6) tines cut cleanly through concrete and asphalt aggregates. Test results suggest that tines could be used advantageously for certain rock cutting applications when rock removal rather than rock production is required. (USBR) W71-09058

## DESIGN OF A WATER CANNON FOR ROCK TUNNELING EXPERIMENTS,

Terraspace, Inc, Bethesda, Md.

William C. Cooley, Franklin L. Beck, and Daniel I..

Available from the National Technical Information Service as PB-198 050, \$3.00 in paper copy, \$0.95 in microfiche. DOT-Office of High Speed Ground Transportation Report FRA-RT-71-70, Jan 15, 1971. 76 p. DOT-FR-00017. Descriptors: \*Tunneling, \*Excavation, \*Tunneling machines, Rock mechanics, \*Jets, Rock excava-

tion, Fractures.
Identifiers: \*Hydraulic jets, Hydraulic servomechanisms, Pneumatic servomechanisms, \*Water cannons.

A detailed design is presented for manufacturing a high pressure pulsed water cannon for rock-breaking experiments in a tunnel or quarry at jet pressures up to 106 psi. The test system includes a trailer for carrying the water cannon, and a separate dolly for the power system and controls. The water cannon incorporates components of a Terrapak hydro-pneumatic actuator and is designed to fire one pulse every 5 minutes, but can be modified to fire 20 pulses per minute with a pulse energy of 93,500 ft.lbs. This report covers the system analysis, design studies and detailed design of the water cannon system and discusses fabrication, operation and test procedures.
W71-09362

#### 10. SCIENTIFIC AND TECHNICAL INFORMATION

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES, ATLANTIC-PACIFIC INTEROCEANIC CANAL, BIBLIOG-

RAPHY, Battelle Memorial Inst., Columbus, Ohio. For primary bibliographic entry see Field 05C. W71-09006

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES, ATLANTIC-PACIFIC INTEROCEANIC CANAL, POSSIBLE EFFECTS OF A SEA-LEVEL CANAL ON THE MARINE ECOLOGY OF THE AMERICAN ISTHMIAN REGION, ABSTRACTS, THESAU-

Battelle Memorial Inst., Columbus, Ohio. For primary bibliographic entry see Field 05C. W71-09007

## PRELIMINARY BIBLIOGRAPHY MATHEMATICAL MODELING IN ECOLOGY, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W71-09025

# A SELECTED BIBLIOGRAPHY OF TER-RESTRIAL, FRESHWATER AND MARINE RADIATION ECOLOGY, Washington State Univ., Pullman; and Colorado State Univ., Fort Collins.

For primary bibliographic entry see Field 05C. W71-09232

THE STUDY OF THE PHYSICAL, CHEMICAL AND BIOLOGICAL NATURE OF WATER QUALITY UNDER UTAH CONDITIONS, Utah State Univ., Logan.

For primary bibliographic entry see Field 05A. W71-09268

#### WATER ANALYSIS, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 05A. W71-09289

## HYDROLOGY OF COASTAL WATERS, Texas A and M Univ., College Station; and Texas Engineering Experiment Station, College Station. Coastal and Ocean Engineering Div. For primary bibliographic entry see Field 02L. W71-09365

# INTERACTION OF PESTICIDES WITH AQUATIC MICROORGANISMS AND PLANKTON,

Arizona Univ, Tucson, Dept. of Entolmology. For primary bibliographic entry see Field 05C. W71-09381



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#### CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association Research Foundation.

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